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CONTENTS

13 OCTOBER 1988

NUCLEAR ENGINEERING

SCIENCE & TECHNOLOGY POLICY

SUPERCONDUCTIVITY

TECHNOLOGY TRANSFER

EAST EUROPE

COMPUTERS

LASERS, SENSORS, OPTICS

MICROELECTRONICS

SCIENCE & TECHNOLOGY POLICY

ADVANCED MATERIALS

World Market Growth for High-Performance Composites Studied

3698A217 Paris CPE BULLETIN in French Jan 88 pp 41-44

[Article under the "Data Sheet" rubric: "High-Performance Resins for Composites"]

[Excerpt]

World Market for High-Performance Composites

The world market for high-performance composites, estimated at Fr 7 billion in 1985, should increase by more than 20 percent annually for the next 10 years. The United States controlled nearly 60 percent of the world market in 1985.

Table: World Market for High-Performance Composites (in million francs)

	1985	1990	1995	Average Annual Growth Rate (in percent) 1985-1995
United States	3,900	9,900	23,130	19
Japan	1,430	3,940	11,100	23
Europe	1,550	3,700	10,200	21
including FRG	290	690	1,950	21
Great Britain	285	740	2,050	22
France	330	900	2,380	22
Italy	145	320	890	20
Other	130	460	1,270	26
Total	7,010	18,000	45,720	21

Epoxy resins, accounting for 87 percent of the market, are still the most popular.

Table: Share of the Various Kinds of Reinforcers According to Matrices Used (in market percentages)

Fibers	Matrices				
	Epoxy	Phenolic Resins	Other Thermosetting Plastics	Thermoplastics	Total
Glass	70	8	negligible	negligible	78
Carbon	9	negligible	2	2	13
Aramid	8	1	negligible	negligible	9
Total	87	9	2	2	100

However, it looks as though bismaleimides and thermoplastics will break onto the market. Bismaleimides (BMI) combine implementation conditions similar to those of traditional epoxies with good thermal resistance. The main feature still in need of improvement is resiliency.

Some commercial resins are: Kerimid 70011 from Rhone-Poulenc (France), Narmco 4245 C and 4250 from ARMCO (United States), Hippolite 3000 from Mitsui (Japan), BT 2600 from Mitsubishi (Japan), F 178 from Hexcel (United States), Cycom FA 9120 from Hysol, Compimide 751 and 769 from Technochemie (FRG), and Matrimid 5292 from Ciba-Geigy (Switzerland).

Thermoplastics are expected to make a breakthrough due to their impact resistance and handling ease. Resin suppliers have developed thermostable thermoplastic resins, but some of their intrinsic problems remain to be worked out (quality of preimpregnated board, fatigue and distortion behavior, solvent sensitivity, and use under high pressures and temperatures).

Table. Main High-Performance Thermoplastics

Resin	Supplier	Vitreous Transition Temperature, °C (Fusion Temperature °C)	Working Temperature
Polyether-ether-ketone	ICI	143 (343)	400
Polyarylene ketone (APC HTX)	ICI	205 (386)	420
Polyarylene ketone (PXM 8505)	Amoco	265	
Polyphenylene sulfide (PPS Ryton)	Phillips Petroleum	90 (290)	343
Polyarylene sulfide (PAS-2)	Phillips Petroleum	215	329
Polyarylamide (J. Polymer)	Du Pont de Nemours	120 (279)	343
Polyamide-imide (Torlon)	Amoco	275	400

Table. Main High-Performance Thermoplastics

Resin	Supplier	Vitreous Transition Temperature, °C (Fusion Temperature °C)	Working Temperature
Polyamide-imide (Torlon AI x 638)	Amoco	243	350
Polyetherimide (Ultem 1000)	General Electric	217	343
Polyimide (Avimid K III)	Du Pont de Nemours	251	343-360
Polyimide (LARC TPI)	Mitsui Toatsu	264 (275, 325)	343
Polyimide sulfone $PISO_2$	High Tech Services	273	343
Polysulfone (UDEL P-1700)	Amoco	190	300
Polyaryl sulfone (RADEL A 400)	Amoco	220	330
Polyaryl ether sulfone (Vicitrex 41000 G)	ICI	230	300

Aeronautics is the field that benefits most from high-performance composites applications. The exchange coefficient here (accepted cost to obtain 1 kg) ranges from Fr 1,500 to 3,000 per kilogram. The future of composites appears very promising in the automobile and armament industries. The exchange coefficient in the former is approximately Fr 5/kg, so that the introduction of composites must now be seen as a "task to complete" and no longer piece-by-piece replacement. Stamping a product with a thermoplastic plate gives it good mechanical properties and achieves manufacturing cycles of less than one minute. One drawback, however, is poor surface appearance.

The United States is still the leader in resin manufacture. West Germany is establishing itself as the number-two power in the international market, although the USSR is quickly catching up with Western technology. The United Kingdom has a solid international reputation in basic research.

Some may wonder why Japanese industry does not dominate the high-performance resins market, since it is the leader in world markets for carbon fibers and electronics resins. There are signs that it is gaining strength. Some Japanese companies worked with Italian manufacturers as Boeing subcontractors for the 767. The largest composite structure for the 767 is the streamline designed in Japan.

Table: Major Industrial Research Projects in the FRG

Area of Research	Participants	Total Budget (in DM1,000)
New thermoplastics based on liquid-crystal polymers	Bayer	1,770
High-performance resins	DFVLR [German R&D Institute for Space Travel] (Cologne), Schott Glaswerke, Sigri, Technical University of Berlin, University of Karlsruhe	5,850
New resins	Bakelite, Erka A6, Sigri, Technochemie, University of Stuttgart	4,480
High-performance composites	Bayer	5,135
High-performance polymers	Federal Office for Materials Verification	839

Table: Research in the UK

Center	Resins Studied
University of Bristol	Epoxy, thermoplastics
T&N Materials Research	Epoxy, phenolics, other thermosettings and thermoplastics
University of Surrey	Epoxy
Cambridge University	Epoxy, thermoplastics
Brunel University	Polyamides, thermoplastics, thermostables, epoxy
Fothergill Rotorway Composites Ltd.	Epoxy, polyimides, phenolics, thermoplastics
National Engineering Laboratory	Epoxy
Royal Aircraft Establishment	Epoxy, thermoplastic polyimides, other

Table: Research in the UK

Center	Resins Studied
Fiberglass Reinforcements	Epoxy, polyimides, phenolics, other
BP Chemical	Phenolics, epoxy
ERA Technology Ltd.	Epoxy, polyimides, thermostables
University of Liverpool	Epoxy, phenolics, thermostables, other
University of Bath	Epoxy
Dunlop Ltd.	Epoxy, polyimides, phenolics, thermostables
Hepworth Plastics Ltd.	Epoxy, phenolics
Russel House Laboratories	Epoxy, polyimides
Dowty Rotol Ltd.	Epoxy, thermostables
AERE Harwell	Epoxy, other thermosettings and thermoplastics
Kingston Polytechnic	Epoxy, phenolics, thermostables
Plymouth Polytechnic	Epoxy
National Physical Laboratory	Epoxy, phenolics, thermoplastics

Table: Research in the FRG

University, Company	Matrices Studied
Hoechst AG	Polyesters, vinyl esters, liquid crystal polymers
University of Kassel	Epoxy, polyesters, vinyl esters
University of Stuttgart	Epoxy, phenolics, thermoplastics
University of Karlsruhe	Epoxy, thermostables, thermoplastics
Technical University of Hamburg	Epoxy, thermoplastics
DFVLR	Epoxy, polyimides, thermoplastics
University of Hannover	Epoxy, polyesters, vinyl esters
Aeronautics and Light Construction Institute of Brunswick University	Polyesters, epoxy, phenolics
MBB [Messerschmitt-Boelkow-Blohm]	Polyesters, epoxy, phenolics, silicone, thermoplastics, thermostables
Material Research Institute	Epoxy, polyimides, thermoplastics
Institute for Synthetic Materials Processing	Epoxy, polyimides, other thermostables, thermoplastics
RWTH Aachen	Epoxy
Dornier	Epoxy
Sigri	Epoxy, polyimides, thermostables, thermoplastics
Air and Space Institute	Epoxy
Institute for Polymer Preparation	Epoxy, polyimides, thermoplastics

25069

French Surface Treatment R&D Profiled

3698A218 Paris CPE BULLETIN in French Jan 88 pp 45-48

[Article by Guy Benchimo under the "Data Sheet" rubric: "Technological Innovation and Surface Treatment"]

[Text] A colloquium on surface treatment R&D was organized by the CPE [Center for Forecasting and Evaluation] on 11 and 12 January 1988, on behalf of the Ministry of Research and Higher Education[1] and the Ministries of Industry, and of Post, Telecommunications, and Tourism[2] with the participation of the DGA [General Arms Authority], DRET [Directorate for Research, Studies, and Technologies of the Ministry of Defense], and ETCA [Space Technology and Construction Studies]. The purpose of the meeting was to review the multiannual R&D program launched in 1984 as part of the Scientific and Technical Mission of the Ministry of Research on new surface treatment technologies. Surface treatment is a major industry: Turnover in France is Fr 17 billion (excluding paints and varnish), representing 2.55 billion square meters of treated surfaces, with 5,500 workers employed in 1,500 free-lance shops (1,700 wage earners) and 2,900 integrated workshops (38,000 [as published; ?3,800] wage earners). If we include paints and varnish, the figures are Fr 30 billion and 100,000 salaried workers.

In addition, the trend toward "multimaterials", i.e. several materials, often with incompatible properties, combined to produce a unique material, offers the prospect of new products and means that costly materials do

not always have to be used. This is particularly true in the case of surface treatments (particularly regarding tribology, corrosion, hardness, appearance, conductivity, weldability, etc).

A. Surface Treatment Research

The problems of surface treatment research are particularly serious. According to the firm Hydromecanique et Frottements, it takes 7 years and Fr 10 million to develop a new treatment. In the case of deposition without a vacuum, it takes 10 to 12 years and Fr 30 to 40 million. We may well wonder how profitable it is:

- In industry as a whole, surface treatments are applied everywhere:

—In microelectronics, connectors are gold-plated and integrated circuits have silver- or gold-plated grids;

—In the automobile industry, engines have nitrided crankshafts and segments are molybdenum-coated, etc. Surface treatments often save money in the manufacturing process and also create jobs.

- In the case of specific companies, we can look, for example, at Hydromecanique et Frottements, whose parent company is devoted entirely to research and employs 175 workers, while its operating subsidiary has 25 employees dealing exclusively in custom-made articles. Twenty percent of turnover comes from product licenses and supplies, which enables research to pay for itself.

B. Current Trends

Several trends are taking shape:

Efforts are being made to integrate the traditional treatment field. As a result, we should be seeing fewer and fewer separate workshops for thermal treatment. The treatment itself should be pollution-free, integrated into the manufacturing process, and as flexible as possible. These changes require automatic control, which in turn calls for thorough knowledge of the physical and chemical phenomena which make modeling possible. Considerable work has been carried out by a team led by Professor Gantois, president of the National Polytechnic Institute of Lorraine. The team, from the Metallurgical Engineering Laboratory directed by Gantois at the Nancy Mining School, has been working in the areas of gaseous carbonizing, ion nitriding, and physical vapor deposition (PVD). This has taken 5 years of effort and investment in heavy equipment, half of which was financed by the government, with the institutions' own resources covering the other half (four-fifths of the latter came from industrial contracts and one-fifth from the university budget).

1. Carbonizing

Research has shown that atmospheric control should produce maximum carbon penetration in steel in the least amount of time, in order to assist carbon oxide's decomposition into carbon and oxygen. Research has also shown that measuring the oxygen content could ensure optimal control in real time with a 50-to-100-percent increase in productivity compared to traditional methods.

2. Ion Nitriding

The study of nitride formation conditions has revealed that reactive species are not nitrogen ions formed in plasma but electrically neutral species. When plasma is obtained under low pressure, these neutral species are not carried by electrical discharges but by the flow within the reactor. It follows from this discovery that low-density plasmas and gas mixtures favorable to active species ought to be used. The presence of oxygen, for example, produces compound formation 3-to-4 times faster.

The industrial process derived from this theory consists in placing the piece to be treated in a furnace where a gas current is pumped in after having passed through a cold plasma. The plasma is obtained by a low-pressure electrostatic field, or preferably an electromagnetic field (microwaves), so that higher pressures, such as atmospheric pressure, can be used. This is an advantage for industrial processing.

3. PVD Techniques

These techniques are not as advanced as the preceding two: modeling has not been accomplished and therefore integration is not yet possible.

Nevertheless, these methods look promising, because alloys can be transferred to several elements using a cold cathode and plasma confined in a magnetic field. One example is stainless steel nickel chrome with its varying amounts of carbon (depending on the amount of methane added to the atmosphere). This process produces amorphous microcrystalline deposits with the properties of stainless steel alloys. The surface is extremely hard (1,200 Vickers) and has the corrosion properties of palladium. In cases like these, we can say that we are heading toward the creation of new materials.

C. Other Topics

It is not possible to mention all the topics brought up during the colloquium in this brief overview; however, some of the main ones are:

—**Surface treatment of zircon by CO_2 lasers,** presented by Alain Petitbon (Marcoussis Laboratories). The purpose is to mechanically strengthen thermomechanical ceramics by eliminating surface defects. The addition of aluminum oxide in atomized powder form to the

laser beam while the zircon is being treated causes a fine, homogenous film of aluminum oxide/zircon composite to form, reducing porosity and increasing hardness;

—**Advantages of electropolymerization,** i.e., in situ polymerization of a monomer in solution on a galvanized substrate, presented by J.C. Laout of CERIPEC [Research and Study Center for Painting and Allied Industries], using phenolic derivatives in alkaline methanol;

—**Treatment of waste water** from surface treatment workshops—which causes one-third of the toxic pollution in France—without waste disposal. R. Wilmotte (Director of CRITT [Regional Innovation and Technology Transfer Center] "Surface Treatment" in Reims) suggests this be accomplished by the use of new ion exchanger media—grafted cellulose—developed by ITF in Lyon.

D. Conclusion

The trend is toward integrated surface treatments and increasingly thinner treatment films accompanied by surface alterations. This can be seen in ion implantation on one-tenth of a micrometer or in amorphization, both of which avoid the problem of compatibility between film and substrate as well as adherence problems.

Such advances are possible only if researchers and industrialists cooperate closely. Researchers must be aware of company needs, and industrialists must be kept abreast of research in progress. Contacts among European partners should lead to better awareness of each other's work methods. Standards ought to be a catalyst in this area, because they could lead to a consensus among partners. A good idea would be to encourage the presence of engineers from widely different companies on committees.

Footnotes 1.Raoul Monin, head of the Machinery, Optics, and Aeronautics Department. 2.Alain Van Huffel, head of the General Machinery Division.

25069

FRG's Aachen Center Studies Solidification in Microgravity

36980363 Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 16 Jun 88 p 8

[Article: "Main Research Goals of 'Access' Are Super Alloys. Experiments in Weightlessness. Composite Materials for Turbines. New Generation of Smelting Furnaces"]

[Excerpts] The "Aachen Center for Solidification Under Weightlessness (Access)" is working on these problems. It is headed by Prof Dr Peter R. Sahm, Director of the Foundry Institute at the Rhein-Westphalia Technical University in Aachen. A "Center for Physical Chemistry Under Weightlessness (CVP)" with Dr Joachim Richter from the physical chemistry education and research section was also recently founded in Aachen. Thirty institutes at the technical university and the vocational college in Aachen joined together at the beginning of this year to form the "Aachen Space Forum." It is an interdisciplinary working group for the promotion of space research and technology with a view to the peaceful use of space in conjunction with industry and research institutions.

The objective of the forum is the concentration and coordination of the considerable technical and scientific potential within this sector in Aachen. Prof Sahm has excellent applicable experience—he was the scientific project manager of the D-1 mission (Spacelab) as early as 1982 and has taken over the same role for the D-2 mission. One of the objectives of this mission is the use of weightlessness by German industry and research groups in the area of life sciences and materials sciences.

Several research options are available for conducting experiments under conditions of weightlessness or microgravity. These include tests in space—exclusive of the D-missions—within the scope of the Texus program (technical experiments under weightlessness) using high-altitude research rockets. Management of the project is in the hands of the DFVLR [German Research and Experimental Institute for Aeronautics and Astronautics]. Top altitudes of around 260 kilometers permit an experimentation period of six minutes. Simulation possibilities involving brief periods of weightlessness in aircraft in parabolic flight also continue to be tested.

Tests can also be conducted on the ground. A dropping shaft assembly is located at the Technical University of Aachen's Foundry Institute. The dropping distance measures three meters; it can be evacuated and flooded with a controlled atmosphere. The experimentation period lasts one third of a second. A one-hundred-meter tall dropping tower is expected to be available soon at the University of Bremen; the experimentation period there will be two seconds. The Aachen researchers have already announced some experiments. The tests in the Aachen dropping shaft assembly are directed primarily toward the possibilities of containerless solidification of molten metals in order to obtain amorphous materials which must withstand extreme loads.

The "Aachen Center" is additionally involved with supercooling tests under weightlessness, with problems of self-diffusion in melts and with dendritic growth. Included here is the increased use of these crystal formations, which appear branched or moss-like, in aluminum alloys. The growing of single crystals is likewise part of the agenda; in particular, the development of II-V and II-VI semiconductors is envisioned. Within the framework of modeling systems the Aachen scientists also

want to conduct microscopic observations of solidification and take interferometric and holographic measurements. It must then be determined whether this information can be transferred to alloy systems.

In Aachen there is a very special interest in the development of metal-ceramic composites which can be used as high-temperature materials in the form of dispersion-hardened alloys. In such a material, for instance, the single-crystal matrix of a superalloy is reinforced by homogeneously distributed, very fine granules of ceramic particles. The polycrystalline materials used up to now are more voluminous, heavier and not as heat-resistant.

The composite can only be obtained, however, if several boundary conditions are met. Solidification of the dispersion, for example, can only be effected under conditions of microgravity because in an earth-bound laboratory metals and ceramics separate due to gravity-induced hydrostatic buoyancy. Gravity-induced thermal convection also leads to collisions and agglomerations of ceramic particles. Finally, the ceramic powder must be able to be wetted by the liquid metal. Otherwise the particles clump together and the reinforcing effect is lost. Therefore, the study of the wetting behavior between oxide ceramics and nickel-based superalloys is one of the primary research objectives of "Access." The project bears the acronym "Osiris" (micro-design of an oxide dispersion strengthened single crystal improved by resolidification in space) and is being financed by the FRG Ministry of Research and Technology and the DFVLR in conjunction with MAN-Technology of Munich, the Krupp Research Institute in Essen, Thyssen-Guss AG of Bochum and MTU of Munich.

"Access" considers it one of its tasks to make it possible for potential users to become involved in industrial space research. The same purpose is served by the joint venture of companies interested in aviation and aerospace which is coordinated by Prof Sahm and promoted by the North Rhine/Westphalia Ministry for Economics, Small-Scale Industry and Technology. The first workshop along these lines is expected to be held soon in Aachen with support from Dornier Systems. Its purpose is to evaluate the experiences gained in the D-1 mission. Experiments involving the weightlessness of space must be secured three times over because they will take place in the presence of humans. The American space agency NASA specifies in detail the what and how of "packaging." There must be no outgassing. For example, under weightlessness the molten material in the smelting furnace not only expands upward but also in all sideways directions, which means that the ceramic sleeve can rupture, as was shown in an aluminum-magnesium test. Therefore, there must be a mechanism for providing homogeneous volumetric compensation. The seminar is supposed to be used to plan a new generation of smelting furnaces. The results should allow the participating companies to see whether they have the potential to manufacture and develop the special components for such a space furnace.

12552

AEROSPACE, CIVIL AVIATION

ESA Continues Preparations for Ariane-5

ELA-3 Launch Site

36980388 Paris LE MONDE in French 27 Jul 88 p 15

[Article by Jean-Francois Augereau: "A Giant Step"]

[Excerpts] In Guiana, bulldozers are digging over and reshaping the savannah to prepare ground for the European space exploits of the year 2000.

The ELA-3 construction site is not just another site. It has nothing in common with the first ELA-1 launching pad inherited from the last years of the Europa-2 rocket. Nothing in common either with the brand new ELA-2 complex, built at a cost of a little over Fr1 billion under 1984 economic conditions, which should make it possible to launch, practically until the end of the century, the 70 Ariane-4 which the Europeans are planning to build. ELA-3 will be built on a larger scale: 600 hectares will be made available to build all the facilities of this project.

It would be hard to make do with less, considering what is involved:

- Building a new plant to produce the propellant powder used to fuel the two huge boosters located on opposite sides of the Ariane-5 first stage;
- Building a production plant for liquid hydrogen and another for liquid oxygen and nitrogen, to be used in Vulcain, the 100-ton-thrust cryogenic motor currently being developed by the European Propulsion Company (SEP) and its European partners. This high-performance motor will propel the first stage of the launcher;
- Setting up the test benches required for the development and qualification of the main propulsion stages of Ariane-5;
- Building the integration hall where the launcher will be assembled, and the hall where the boosters will be added to it;
- Finally, building an armored launching center and, in particular, the 7-km long railroad that will take to its launching pad the fully-assembled launcher mounted on its launching platform;[1]
- In other words, preparing all auxiliary infrastructures—offices, parking lots, power plant, etc.—required for a launching, remembering to provide for those—including a landing strip—that will have to be built for the future Hermes program.[2]

In brief, a giant construction site on which work should be completed by 1994, i.e., 1 year before the first flight of Ariane-5 (Ariane-501 flight). No less than 2.5 million cubic meters of earth will be turned over, leveled and reshaped; 150,000 tons of concrete will be poured, 70 km of cable links—including 30 km of fiber optic cables—will crisscross the launching site. Enough to keep 1,000 people—25 percent of whom are technicians from Europe—at work until 1992. The others will come from Colombia, Brazil... and

even the Philippines, in order to complete the project at a cost of 725 million accounting units (approximately Fr5 billion, or about one fifth of the Ariane-5 project), close to half of which (43 percent) will be financed by France.

Footnotes

1. Two launching platforms will be built to guarantee that the Ariane-5 clientele can be offered a launching rate of eight launches per year. Each launching platform will weigh 1,500 tons.

2. The items concerning the Hermes program are not included in the budget allocated for ELA-3.

Ground Test, Control Systems

36980388 Paris LE MONDE in French 27 Jul 88 p 8

[Article: "MATRA [Mechanics, Aviation and Traction Company] to Control Ariane Ground Systems"]

[Text] The CNES [National Center for Space Studies] has just appointed MATRA as prime contractor for the ground testing and control systems of Ariane-5 and its future ELA-3 launching pad.

It is not really a contract that the CNES just awarded to MATRA Space; rather, it appointed it to complete studies in this respect. At maturity, the project should lead to the delivery of some 10 test benches for the various European sites and the Kourou launching pad. The software will be supplied by the Belgian company ETCA.

The contract will represent a total of Fr450 to 500 million. MATRA Space is also about to bid for the control and maintenance operations of ELA-2, for which it will compete, among other companies, with SODETEG [Technical Studies and General Enterprises Company].

MATRA, in addition, is already in charge of the testing systems of the HM-60 motor, and it had been trying to get this new assignment for a long time.

As is known, MATRA Space is, with MATRA Defense, one of the branches of the MATRA company that are headed by Noel Forgeard. A third branch was added late last month, with TII, which will constitute an interface between the first two branches as it specializes in aids to command, communications and imagery for military purposes.

9294

Hermes Design Tests Continue

36980361b Stuttgart FLUG REVIEW in German Jul 88 p 84

[Article by Goetz Wange: "Balloon Experiment for Hermes"]

[Text]Aerodynamics is to be checked with a model of the space flyer Hermes, which is ejected after a balloon ascent.

Since it is now certain that the safety cabin of the European Space glider Hermes, the crew escape module (CEM), will be developed by German industry, preliminary work has been intensified. Thus, Dornier Company has tested a 1:6 model of the detachable can in its wind tunnel. What was primarily investigated here was the action of the aerodynamic brake, for which two extendable flaps are affixed on the top side of the cabin. This system is supposed to reduce the falling speed of Hermes to such an extent that the built-in parachute system can act, by means of which the last component section until landing on the ground is supposed to be traversed.

The aerodynamics of the entire spacecraft Hermes belongs to the work packet of the French company Dessault. By and large, the wing outline and profile, the wing and guidance arrangement, as well as the fuselage contour have been fixed. More recent investigations—for example, measurements in the hypersonic range—will presumably lead only to changes in detail. The configuration on which the present work is based is the designation 5M2.

Despite all calculations and tests in various wind tunnels, there are still a number of uncertainties regarding the flight behavior of Hermes after it enters the earth's atmosphere. A remedy is supposed to be provided by an experiment which has been conceived by the Bremen firm OHB under the designation "Falcon." The basis for this is experience with the balloon-borne experimental capsule Microba, which is used for gravity-free simulations. In order to be able to verify the quality of the simulation, there is a measurement system in the capsule, which measures all acceleration forces. A similar measurement system is now to be installed into a 6-meter long model of the space glider Hermes, which is being constructed by Hoffman Aircraft Construction under sub-contract with the OHB.

In the meantime, the French space agency CNES has accepted this German assistance, which is being funded by the BMFT/DFVLR (Federal Ministry for Research and Technology/German Aerospace Research Institute) from national funds. The CNES will start the study with a balloon which will carry the model to a height of 40 KM. After the model has been ejected, a speed of Mach 1.6 is supposed to be reached at a height of 25 KM. The automatically controlled flight can then be measured until landing. For re-use, recovery will be effected with a

parachute. The data that will be obtained from the 350 to 400 kg heavy model can readily be transferred to the space glider, in the view of the OHB.

However, as first step, a model of the Space Shuttle will be tested in the same way. It will weigh about 500 kg. Because all the measurement data are available concerning the landing approach of the American Space transport, a comparison with the model test is also very informative for the Hermes tests.

08348

BIOTECHNOLOGY

Irish National Biotechnology Program Described

3698A298 Paris BIOFUTUR in French and English Jul-Aug 88 pp 41-46

[Article by James Ryan of BioResearch Ireland, Eolas, Glasvenin, Dublin 9, Ireland: "Ireland's National Biotechnology Programme"; first paragraph is translation from French of BIOFUTUR introduction, remainder of article in English]

[Text] Since 1983, the Irish Government has made biotechnology one of its priority programs. It can now take pride in having attained "historic" results. It has succeeded in modernizing traditional industries, attracting large pharmaceutical companies, and creating a real synergy between research and industry. Another achievement has been the establishment of BioResearch Ireland, which tries to bring about commercial implementation of Irish biotechnology research results.

Biotechnology is relevant to a large proportion of Irish industry. These industries include the traditional sectors such as brewing, distilling, and cheese manufacture, and a significant health-care industry which has developed mainly over the last 20 years. Many international manufacturing companies, including 10 of the top 15 pharmaceutical companies in the world, have been attracted to Ireland and have made it the world's 10th largest exporter of pharmaceuticals. There are 22 companies of French origin in Ireland currently employing around 1,000 people. Most recent investment has come from Servier Laboratories who are building a plant at Arklow, Co Wicklow.

Pharmaceutical and chemical companies employ 6 percent of the Irish manufacturing workforce, while the food and drink industry employs 24 percent. There is also a significant health-care instrumentation and diagnostics industry. Some Irish companies are shown in Table 1.

Table 1. Examples of Irish Biotechnology Companies

Company	Products/biotechnology interests
Avonmore Creameries Dairy	Products/research on new cheese development and cheese flavour problems
Biocon Biochemicals	Enzymes, flavourings, and natural colours for food and drink, pharmaceutical and diagnostic industries
Bord Bainne Ltd	Dairy products/cheese production and flavour technology
Carbery Milk Products Ltd	Dairy products, including alcohol produced from whey
Elan Corporation	Pharmaceuticals and drug-delivery systems
Flemming GmbH	Large range of clinical chemistry and immunodiagnostic assays
Guinness Irl. Ltd	Beer/process and product development, including genetic engineering of brewing yeast
Institute of Clinical Pharmacology	Clinical testing services, renal and hepatic pharmacology, cellular pharmacology, psychopharmacology, and immune pharmacology
Irish Distillers Ltd	Alcoholic beverages/development of brewing and fermentation processes for whisky production. Use of pure culture yeasts.
Irish Sugar Co.	Sugar, animal feeds, processed vegetables/biological control and beet disease, improvement of N-fixing Rhizobia
InterBio Laboratories Ltd	Microbial and enzyme products for soil improvement, silage enhancement, waste treatment, and oil pollution control
Kerry Co-Op Ltd	Dairy products, casein and other milk-derived proteins
Medlabs Ltd	Diagnostic reagents and kits (e.g., ANA, protein A, cancer markers)
Noctech Ltd	Veterinary and human diagnostic kits (hepatitis delta antigen)
Organon Teknica	Diagnostic kits for clinical laboratories
Pfizer Chemical	Citric acid and other chemicals and pharmaceuticals/culture improvement for production of citric acid
Plant Biotechnology (UCC) Ltd	Plant health care and breeding research services to industry
Richland Supplies	Animal diagnostic kits, vaccines, and analytical services

The major factors which cause these companies to locate in Ireland are the availability of a skilled labour force, and the attractive package of grants and tax incentives offered by the Industrial Development Authority (IDA). Irish universities have a long history of biological and medical training and research. Technical education has increased significantly in the last twenty years to cater for the increased numbers of companies locating in Ireland. The

number of science graduates has increased by 30 percent over the last 10 years, for instance. Much of the biomedical and agricultural expertise in Irish colleges has also been specifically directed toward biotechnology. Almost half of Irish university-based researchersare in biotechnology-related areas, i.e., biology, medicine, or agriculture. Some of their interests are shown in Table 2.

Thus Ireland has both an industrial need for development of its biotechnology and a research base which provides an opportunity to do so successfully.

Table 2. Major Biotechnology Research Themes in Irish Universities

Research Centre	Research Area
National Institute for Higher Education (Dublin)	Monoclonal antibody production Animal cell culture, up to pilot scale Biochemical engineering Microbial and mammalian molecular genetics In vitro toxicology and hormone bioassay
University College, Cork	Food biotechnology —starter-culture improvements —functional food proteins —flavour technology Meat biotechnology Plant biotechnology Rhizobial strain improvement Biological control of phytopathogens Protein chemistry Genetic engineering applied to bioprocessing
University College, Dublin	Veterinary and plant diagnostics Enzyme and fermentation technology Plant cell and tissue culture, and plant breeding In vitro fertilization, sexing, transfer, and storage of mammalian embryos Pharmaceutical and medical biotechnology
University College, Galway	Immunodiagnostics and DNA probe development Diagnostic technology Waste degradation processes Enzymology and fermentation Expression of eukaryotic genes and transgenic animals
St Patrick's College, Maynooth	Plant tissue culture for secondary metabolites Microbial crop protection Silage microbiology Monoclonal antibodies
Trinity College, Dublin	rDNA applications to pharmaceutical and industrial enzyme production Genetics of malignant and inherited diseases Virology and vaccine production Enzyme purification and immobilization Radio-immunoassay and biopharmaceutical development

THE NATIONAL BIOTECHNOLOGY PROGRAMME

Development of Irish biotechnology expertise began in 1983 when biotechnology was made a priority in government-funded university research grant schemes. TheAgricultural Institute also began a biotechnology research programme (see Table 3), and a national biotechnology newsletter, "Irish Biotech News," was launched to help coordinate national efforts.

Table 3. Major Biotechnology Research Themes of the Agricultural Institute

Research Centre	Research Area
Kinsealy Research Centre	Micropropagation of trees and ornamental plants; protoplast culture and mutagenesis; plant breeding; plant pathology and mycology
Moorepark Research Centre	Protein engineering; cheese starter-culture technology; physiology and biochemistry of lactic acid bacteria
Oakpark Research Centre	Crop breeding
Western Research Centre	Embryo transfer technology

In 1987 Ireland elected a new Government whose election strategy emphasized investment in science and technology for economic development. This government appointed Ireland's first Minister for Science and Technology, Dr Sean Mc Carthy TD who, in June 1987, launched a National Biotechnology Programme aimed at the development of commercial biotechnology research services. This led to the formation of BioResearch Ireland, a contract research organization described below.

The rationale for development of the National Biotechnology Programme is that there is a large amount of biotechnology expertise in Irish universities which is not being used by industry. As in many countries, the contacts between university researchers and Irish industry are not sufficiently strong. Many university laboratories lack the type and scale of equipment needed to perform industrial research. An additional factor is that the structure of Irish industry is such that R&D spending has been low. The major indigenous food and drink industries have traditionally been low R&D spenders while few multinational pharmaceutical or chemical companies have, until recently, located their R&D facilities in Ireland.

This problem is being tackled through the introduction, by the Industrial Development Authority, of new financial incentives for R&D performance. These incentives, and a growing realization of the importance of R&D among non-performing Irish companies, is resulting in a significant increase in R&D performance by Irish bio-industry. Many multinational companies have also opted to locate R&D in Ireland. Arthur Guinness & Co. Ltd., for instance, has located its worldwide brewing R&D centre in Dublin.

In order to develop Irish bio-industry, the National Biotechnology Programme set out to enhance university-based expertise and facilities so as to make them more capable of performing research for both Irish and overseas industries. This strengthening of biotechnology facilities is expected further to enhance the attractiveness of Ireland as a location for multinational biotechnology companies.

The funding provided through the National Biotechnology Programme in 1987 was devoted to the establishment of biotechnology centres in three of the six major higher-education colleges. The centres are:

- National Food Biotechnology Centre in University College, Cork;
- National Diagnostics Centre in University College, Galway;
- National Cell & Tissue Culture Centre in the National Institute for Higher Education [NIHE], Dublin.

These centres are administratively distinct from the universities, although they are physically located within the laboratories of each university. The funding available through the programme has been used to purchase new equipment and to hire additional research staff. The centres are engaged in commercial biotechnology research on behalf of Irish and overseas industry.

To manage these centres, and to market their services to Irish and international industry, a contract research organization, BioResearch Ireland, has been set up. It is planned to establish this organization as a public company by 1990.

In February 1988, the National Biotechnology Programme was expanded to provide funds for development of research facilities outside the initial three centres. The research services of these additional laboratories will also be marketed by BioResearch Ireland, which will therefore be a mechanism to commercialize all Irish publicly funded biotechnology research. It is the first known attempt to do this on a national scale.

The areas of research within BioResearch Ireland's National Centres are described below and are also listed in figure 4.

National Diagnostics Centre

This centre is located within University College, Galway, and its research is aimed mainly at the development of non-radioactive enzyme-linked immunoassays and DNA probes. Examples include assays for indicators of abnormal bone metabolism, which are being developed by Prof P. Fottrell. These assays are intended for monitoring of bone healing processes following fractures and for diagnosis of conditions such as osteoporosis, a major problem among older women.

A related area of interest in the laboratories of Prof Fottrell and of Dr J. Gosling is development of assays for specific steroid hormones, and their metabolites, for use in determination of fertility problems. This research has been in progress at the university for many years, and has already led to the development of a commercial progesterone assay for pregnancy detection in farm animals. This is marketed by Noctech Ltd (see Table 1). Researchers here are also developing direct luminescent and enzyme-immuno assays for detection of hormones in saliva.

Apart from the use of saliva as a medium for diagnostic sampling, research is also underway in Dr Gosling's group on other aspects of diagnostic technology. Solid-phase EIA techniques are being developed which have a much higher specificity for target antigens and a corresponding low affinity for other molecules which might interfere with the diagnostic "signal."

The centre is building on existing research in Dr Frank Gannon's Laboratory with Epstein-Barr-Virus to develop techniques for detection of pathogenic organisms based both on monoclonal antibodies, and on DNA probes.

Research on characterisation of blood proteins, and particularly assays for IgG and IgA subclasses, is also in progress in Dr John Greally's laboratory. These assays will be an important means of assessing problems in patients suffering chronic or recurring infections.

Based on the extensive mariculture expertise available in the University, assays are also being developed by Dr Peter Smith for diseases of farmed fish. BioResearch Ireland currently provides the routine disease diagnostic service for 80 percent of Irish salmon farms. The diseases of current interest are pancreatic disease, furunculosis, and bacterial kidney disease.

National Cell and Tissue Culture Centre

This centre is located within the National Institute for Higher Education (NIHE) Dublin. This college, established in 1980, has developed significant expertise in several aspects of this work in particular animal cell culture and monoclonal antibody production. The centre specialises in research on all aspects related to the growth in culture of animal cells, as well as the technology related to their products. Particular topics of interest include the development of defined cell-culture media using alternatives to foetal calf serum, also of cell-based bio-assay systems to assess the biological activity of growth factors. A project to assess pro-insulin biological activity is currently in progress.

The centre also raises human monoclonal antibodies for targetting, imaging, and diagnostic purposes. Research is in progress on development, by mutagenesis, or by DNA transfer, of variant cell lines with specific properties; and on the use of cultured cells for toxicity, efficacy, and testing of pharmaceuticals.

National Food Biotechnology Centre

This centre is based within the Food Science and Science faculties of University College, Cork, which have strong links with the Irish food industry. The potential impact of the research being conducted at this centre ranges from the food-crop production stage to the final stage of food processing.

At the crop production stage the major interest is in development of improved strains of nitrogen-fixing Rhizobium bacteria and of strains of Pseudomonas for biological control of plant pathogens.

The application of new biotechnology to cheese production is also a major theme. Research is in progress on development of improved starter-culture strains, and on acceleration of cheese ripening. Researchers are also investigating the natural flavours of food products. The research is investigating the key steps in production of flavour compounds by microbial cultures, and is aimed at identifying the compounds and regulation involved. Also in progress is research on the isolation and characterization of new functional food-protein products from dairy and meat sources.

MAJOR AREAS OF BIOTECHNOLOGY EXPERTISE

The major sources of biotechnology research expertise in Ireland are the universities and the Agricultural Institute, which has significant expertise in agricultural and food biotechnology. The major areas of expertise within these centres is shown in Tables 2 and 3. Examples of some of the research in progress is given below.

Recombinant DNA Research

The team of Prof David McConnell in Trinity College, Dublin, is involved in microbial gene expression, especially in B. subtilis and Saccharomyces cerevisiae. This is one of the few international laboratories which has cloned the chymosin gene. The team has also cloned genes for several important industrial enzymes (beta-glucanase, alpha-amylase) and currently has a contract to clone the porcine growth hormone gene.

In University College, Galway, rDNA research is in progress on cloning, expression, and analysis of eukaryotic genes, and development of transgenic animals. This work is being done by Dr Frank Gannon, who is the Director of the National Diagnostics Centre (see "National Diagnostic Centre"). The application of genetic engineering to Diagnostics is a major interest in this laboratory.

Also in this College, Prof L.K. Dunican is applying genetic techniques to the improvement of amino acid production by Corynebacteria, while Dr D. Headon has

cloned the gene for bovine inhibin. This compound, which works by selective inhibition of FSH secretion, has application in increasing ovulation and fertility in cattle.

In the National Institute of Higher Education, Dublin, Dr Thekla Ryan is working on genetic control of enzyme secretions in yeast, and Dr M. O'Connell on the molecular genetics of bacteria involved in N-fixation.

In University College, Cork, gentic engineering research is directed at the development of improved bacterial strains for agricultural and food processing applications. Dr Fergal O'Gara, who is also director of the National Food Biotechnology Centre, is working on improvements of Rhizobium and Pseudomonas strains for N-fixation and biological control respectively. Prof Charles Daly is developing improved strains of starter-culture bacteria. This research, in association with Dr Tim Cogan of the Agricultural Institute, has already produced the starter cultures from which 90 percent of Ireland's cheddar cheese is now made.

The molecular biology of catabolite repression control in bacterial systems is also under investigation with particular emphasis on microorganisms involved in fermentation. Factors influencing plasmid copy number-control and protein secretion from yeast are also being investigated by Dr J. Atkins.

In University College, Dublin, Dr Finian Martin and his team are investigating hormonal and tissue-specific regulation of pituitary gene expression, while Dr T. Gallagher in the Botany Department is investigating transacting factors in the photoregulation of gene expression in Pisum.

Diagnostics and Hybridoma Technology

A National Diagnostics Centre has been established by BioResearch Ireland in University College, Galway, and its research interests are described under "National Diagnostics Centre," while The National Cell and Tissue Culture Centre (see Table 4) is involved in the related area of hybridoma technology.

Table 4. Research Themes at BioResearch Ireland National Centres National Diagnostics Centre, University College, Galway

- Development of monoclonal antibodies to human immunoglobulin subclasses
- Diagnosis of milk contaminating bacteria
- Development of DNA probes for infectious disease diagnosis using EBV as a model system

BioResearch Ireland BioProcessing Unit, University College, Galway

- Fish-disease diagnosis programme
- Development of diagnostic and other techniques for semen analysis, fertility assessment, and sperm-sexing for use in the livestock industry
- Bioinstrumentation—development of instrumentation for use in biomedical and bioanalytical applications
- Development of EIA kits for monitoring bone metabolism
- Development of EIA kits for steroid hormones
- Immunoassays for human inhibin and for delta-6-desaturase

National Food Biotechnology Centre, University College, Cork

- Functionality of whey proteins
- Seasonal changes in cheese quality
- Membrane lipid peroxidation and meat quality
- Fermented meats
- Cheese ripening and accelerated cheese technology
- Microbial innoculant technology
- Whey protein gelation
- Coagulation of skim milk in acid-casein manufacture
- Physiology and genetics of flavour metabolites
- Amino-acid analysis service
- Monoclonal antibody-affinity chromatography systems
- Expression and secretion systems in yeast
- Control of cyst nematodes in food crops

National Cell and Tissue Culture Centre, National Institute for Higher Education, Dublin

- Scale-up of animal-cell culture
- Human monoclonal antibody production
- Investigation of serum batch variation and growth factors in serum
- Cell storage and cell characterization facility
- In vitro hormone bioassay system development
- Transfection of mammalian cells
- In vitro toxicity assessment

In the National Institute for Higher Education, Dr Richard O'Kennedy has produced monoclonal antibodies against activated lymphocytes, apolipoproteins, blood clotting factors, tumor antigens, and drugs. Dr Martin Clynes of this college has also developed an anti-nuclear antibody assay, which is currently marketed by Medlabs Ltd (see Table 1). In St Patrick's College, Maynooth, Dr Tom Cotter is researching monoclonal antibodies as phenotyping agents in diagnosis of leukaemia.

In University College, Galway, Dr Jim Gosling is researching solid-phase immunodiagnostic systems with negligible affinity for non-specific components of plasma and saliva.

In Trinity College, Dublin, Dr Tim Mantle has recently completed a diagnostic assay, based on an isozyme of glutathione-S-transferase, which indicates susceptibility to lung cancer in smokers. This assay will be marketed as

"Mukit" by the Irish company, Medlabs Ltd (see Table 1). Dr Clive Williams is working on antibodies to anti-depressants and their biological target sites. Dr R. Russel is developing monoclonal, and DNA probe, based tests for Chlamydia and for other infectious diseases.

In University College, Dublin, an assay for Fasciola hepatica has been developed by Dr P. Joyce and a delta-hepatitis antigen assay by Dr Alan Shattock. The latter is marketed by Noctech Ltd (see Table 1) as "DeltAssay." Further assays under development include a rapid milk-based assay for mastitis detection, and an assay to routinely detect cell-mediated immune responses to microbial infection. Dr Ciaran Regan's research, on neural tissue differentiation processes, has led to development of immunodiagnostic and cell culture-based assays for identification of compounds with teratogenic effects.

Other significant areas of research include mammalian reproductive technology. Two major research teams (under Prof Gordon in University College, Dublin, and Dr Sreenan in Agricultural Institute) are researching the transfer, in vitro fertilization, sexing, culture, and storage of embryos. In 1987 a company called Ovamass Ltd was formed to commercialize a new technique, developed in Prof Gordon's laboratory, that allows eggs removed from slaughtered cattle to be used for implantation.

In the wide field of pharmaceutical-related biotechnology, interests include studies of drug bioavailability, conducted at Trinity college and elsewhere. The Elan Corporation (see Table 1) is a major international company in this field. The topic of in vitro testing of pharmaceutical efficacy and toxicity is pursued at several centres including University College (Pharmacology Department and Veterinary College), Trinity College, Dublin (Pharmacology Department), and the National Institute for Higher Education. The Institute of Clinical Pharmacology (Table 1), a major international clinical trial organization is also interested in this field of research.

Development of vaccines is a further area of interest. Dr Tim Foster of the Microbiology Department of Trinity College, Dublin, is currently involved in research to identify the virulence determinants of S. aureus, which causes mastitis, with the ultimate objective of developing a mastitis vaccine. His group also works on a vaccine for the fish disease, furunculosis.

Biochemical engineering research is conducted at NIHE and at University College, Dublin (Table 2). At NIHE the main research interests are computer control of fermentation, downstream processing, cell and enzyme immobilization, and waste treatment. In University College Dublin's Chemical Engineering Department, the research interests include measurement of fluid shear effects of cultured plant cells (Department of Botany), and secondary metabolite production by immobilized fungal organisms.

The Argicultural Institute also has a significant level of biotechnology research within its overall research programme. The major themes are shown in Table 3.

All of the research expertise in Irish colleges and research institutes is now potentially availbale to companies through BioResearch Ireland. The establishment of a single contract-research organization to manage the entire national biotechnology effort is a unique mechanism for biotechnology development. Further details on the services of BioResearch Ireland are available from the author.

COMPUTERS

Leading-Edge Swedish, Finnish Hardware Exhibited at 'DATA 88'

36980384b Stockholm MIKRODATORN in Swedish Jul 88 p 89

[Text] Nokia exhibited several new products at "DATA 88" in Sollentuna. They included an intelligent work station called the WS386 based on Intel's 80386 processor, a flat PLASMA screen for 80286- and 80386-based terminals and a VGA monitor that is also adapted to these computers. The company has also supplied a built-in hard disc for Ericsson's Portable PC.

The WS386 is a Swedish-manufactured computer that works at a clock frequency of 20 MHz and has two megabytes of working memory. There is a 70 Mb hard disk in the computer and a 1.2 Mb diskette unit. There is room to insert seven cards, five of them of the so-called AT type. The other two slots are intended for ordinary PC/XT cards. In addition the computer has room for a 32-bit memory expansion card and ports for various printers. A tape unit, another hard disk or a diskette unit can also be installed in the WS386.

This computer can be started with a code word. This means that no unauthorized person can get at the information stored on the hard disk.

The color monitor, model 1025, that Nokia is introducing gives off a very low "radiation" (of the LMF type) and provides a maximum resolution of 640 x 480 dots (VGA) in the color mode. In the text mode it displays 720 x 400 dots on the 14-inch screen.

The picture frequency varies from 60 to 70 Hz depending on the resolution provided by the monitor.

The thin flat PLASMA monitor has a maximum resolution of 720 x 350 dots. The picture surface measures 245 x 179 mm while the monitor is 8 cm thick. A power unit is located inside the monitor. Both light intensity and contrast on the screen can be adjusted in the same way as the gray scale.

The new PLASMA monitor also has the same low electromagnetic field value as the VGA monitor. The graphics card used is a somewhat modified EGA card.

Ericsson's portable computer has now been supplied with a hard disk of approximately 20 Mb and is known as the EPPC HD. The built-in hard disk automatically locks the read/write head when the computer is turned off.

06578

FACTORY AUTOMATION, ROBOTICS

Comau Flexible Robot Arm With Integral Laser Tool

36980364a Landsberg CIM-PRAXIS in German Jun 88 p 34

[Article: "Laser Tools and Robots"]

[Text] The combination of laser and manufacturing machine is feasible for all types of machine tools. Comau, the robot manufacturer in Turin, has fitted its five-axis smart flexible-arm robot with an integral beam path, meaning that nothing more stands in the way of the combination of lasers as tools and robots as automatons. The relationships here are naturally somewhat more complex. Retaining full mobility and at the same time directing the beam to the point of processing without adding unwieldy external beam paths required a great deal of development work on the part of the Turin company. Comau thus came up with a new concept: The flexible-arm robot with integral beam path was born. In the meantime, the 5.50L laser robot is on the market as a "machine tool" which can be equipped with carbon dioxide lasers from various manufacturers. In the Comau robot, nine deflection mirrors guide the laser beam to the optical cutting tool and ultimately to the point of application. Copper mirrors are installed in the joints of the robot. The beam can be deflected regardless of the direction of movement. The length of the beam path throughout the entire optical sequence is constant. In contrast to most external beam paths, no translation is needed within the beam path. A cooling and ventilation system provides adequate temperature stability for the mirrors. The robot can be used with up to 5 kW of laser power. The only condition is a constant beam diameter with a maximum diameter of 35 mm. The focusing lense of the five-axis robot is equipped with thermal protection. A mechanically controlled autofocus system ensures the proper focal length adapted to any given processing task. Due to the optimized configuration of the sequence of mirrors and to automatic switchover of the working gas, the station does not require a specific refit when switching from welding operation to cutting. The combination of the laser tool with the robot as a means of fabrication is usually unsuccessful because of the space problems associated with external flexible beam paths. But robots with external beam paths have also found acceptance for special tasks. Prof Werner Roddeck of the Technical University in Bochum, in conjunction with GMF, Coherent General and Zeiss, has developed a laser/robot combination for laser cutting of three-dimensional sheet metal shapes and has thus also successfully demonstrated the lase r's suitability as a combined tool with an external beam path. 12552

FRG's Fraunhofer Develops Sensor-Aided Robot System

36980364b Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 16 Jun 88 p 8

[Article: "Sensor-Aided Industrial Robots"]

[Text] Frankfurt (SCHA)—The Fraunhofer Institute for Production Engineering and Automation in Stuttgart has developed a sensor-aided industrial robot system for flexible workpiece manipulation. The focal point of the overall control system of the cell is the robot control which is linked to the image processing system and end effector control via a newly developed sensor interface card with its own processor. During a manipulation procedure it is the job of the image processing system to identify the workpieces and to calculate their position and orientation in addition to sending this data to the robot control. It uses a gray-scale system and is based in a commercially available host computer (IBM PC/AT) which was upgraded by the addition of an image processing card of plug-in design. For recognition of randomly presented workpieces and in order to ensure simple operation, a special software package, Robot Vision Control Software (RVCS), was developed with the primary function levels of learning the workpieces, recognition and classification, calibration and library selection. This sensor-aided robot system permits realization of material flow arranged by parts. Due to the sensory capabilities of the manipulation system, a low-cost universal conveyor system can be used. The flexibility of the concept makes it possible to arrange even small lot sizes economically.

12552

LASERS, SENSORS, OPTICS

Netherlands Government Launches Biosensor Research Program

3698A294 Zoetermeer SCIENCE POLICY IN THE NETHERLANDS in English Jun-Jul 88 p 18

[Report entitled "Five Million Guilders for the National Biosensor Programme"]

[Text] The Technical Sciences Centre (STW) has received five million guilders from the Ministry of Economic Affairs for a national biosensor research programme, which is to run until 1993.

Biosensors are electronic or optical sensors coated with a biochemically sensitive layer and are used to measure biological or chemical substances. There are only a small number of these on the market, mainly enzyme electrodes which measure glucose in blood or fluid samples. Most are produced in the United States or Japan. The Ministry had previously funded a preliminary study to inventory biosensors (1984), and a promotion programme in this field (1985-1987), both of which were carried out by the Microelectronics Centre in Twente (CME). Twente Technology Transfer (3Tbv), a private company that has taken over the commercial activities of the CME, is to coordinate the research programme.

MARINE TECHNOLOGY

International Project To Develop Oil-Extraction Submarine

36980384a Stockholm NY TEKNIK in Swedish 16 Jun 88 p 10

[Article by Christer Kallstrom: "Deep-Water Submarine Makes Small Oil Fields More Profitable"]

[Text] Oslo—A specially-designed submarine for developing gas and oil fields at great depths is currently being designed in Norway in a cooperative effort involving a number of European offshore technology companies. The project has acquired Eureka status.

The submarine is especially suitable for developing so-called marginal fields where costs must be reduced to make development profitable.

Norsub, Inc. of Oslo has been working for about a year on designs for the first big submarine capable of performing technical offshore tasks. The concept is 3 years old and comes from Kvaerner of Norway. The project leader is a Swede, Johnny Magnusson, former technical chief at the Navy Diving Center in Sweden where he worked with the URF rescue submarine, among other things.

Deeper Water

"Technological offshore gas and oil activity in Norway is occurring at increasingly greater depths and at more northern latitudes. This increases the problems and the risks presented by development and maintenance. If submarines are used it is no problem to work at almost any depth without being dependent on weather conditions," Johnny Magnusson of Norsub told NY TEKNIK.

There can be many small so-called marginal fields surrounding the big oil and gas fields, often so small that it is not profitable to develop them with traditional platform technology. The new submarine will be a cheaper and more flexible substitute for semi-submersible rigs.

"The submarine will take care of the entire development of production technology as well as the subsequent inspection and maintenance of marginal fields. The oil and gas will then be piped from these fields to platforms at the main field which will have surplus capacity toward the end of the main field's life span.

"A marginal field could be profitable when oil prices are somewhere around 25 kronor ($4) a barrel. Ordinarily the line for profitable development is drawn at $10-20 a barrel," Johnny Magnusson said.

Construction To Start

Norsub, which is designing and testing the model, expects to start building the submarine and its equipment package as early as next year. The submarine is scheduled for completion in 1992.

The submarine will weigh 900 tons and will be 42 meters long, in other words in the same class as smaller military submarines in Sweden and Norway. There will be an 11-man crew, including equipment operators. The submarine will be able to remain under water for 3 weeks at a time and can operate at a depth of at least 450 meters.

It will cost 300 million kronor to build the submarine alone. The equipment package will cost an additional 100 million. Equipment packages are separate modules that are attached to the submarine.

The critical system for the submarine involves energy. The system will be closed and not dependent on air.

"We must have a system that can provide energy for 2 or 3 weeks. And we are leaning toward trying to use a self-contained diesel system," said Johnny Magnusson.

In this system exhaust fumes are expelled into an absorber where the gases are cleaned and returned to the engine along with fresh oxygen. Salt water and a special centrifuge are used to purify the exhaust gases and remove carbon dioxide.

"We have built a prototype system in a submarine hull in Emden. There were problems at first, but now the whole thing seems to function well," Johnny Magnusson said.

Behind the Norsub firm there are a number of big international technology companies that are contributing various parts of the submarine system: ASEA Brown Boveri is responsible for robot technology, Sutec of Sweden is in charge of ROV, the remote-control technology, submarine technology is being provided by West Germany's Thyssen Nordseewerke, Alsthom of France will supply production solutions, Scanmar of Norway will take care of hydroacoustics and navigation technology and Sintef of Norway will handle medical technology

and personnel space. The Kvaerner group's Moss-Rosenberg Shipyard, Willh Wilhelmsen, Neptun Technology and West Germany's Thyssen are responsible for construction.

The Swedish Board for Technical Development [STU], the Norwegian Council for Scientific and Industrial Research [NTNF] and their West German and French counterparts are providing funds for the technical development phase of the project which has cost 20 million kronor so far.

06578

MICROELECTRONICS

Europeans Pursue U.S. Joint Ventures in Microelectronics

Siemens, Intel Joint Venture

36980362 Munich EEE in German 21 Jun 88 p 1

[Text] Stuttgart—Siemens AG, Berlin and Munich, and Intel Corporation, Santa Clara (United States) have agreed to establish a joint computer firm in Oregon. This joint venture, in which Siemens and Intel each have a 50-percent share, goes by the name "Biin" (pronounced "bine").

An agreement to this effect was signed in Munich by Dr Karlheinz Kaske, president of Siemens AG, and Dr Andrew Grove, president and chairman of the Intel Corporation.

The joint venture will offer on a global basis computer systems for networked computer applications of especially high reliability.

BiiN will supply products to the North American market from the offices of the company in Hillsboro, Oregon; a German subsidiary company is being founded in Nuernberg for European activities.

The mass production of these computers will begin as early as this year in the FRG and the United States. Joseph J. Kroger, up to now vice chairman of the Unisys Corporation, was appointed president of BiiN.

The plan had already been filed 2 weeks ago with the Federal Office for the Supervision of Cartels in Berlin for an examination of compliance with merger laws. This office further indicated that a speedy clearance can be expected.

Arrangement With AMD

Siemens AG has likewise concluded a contract with Advanced Micro Devices Inc. This is an arrangement on the development, manufacturing, and marketing of chips for data communications and telecommunications; the emphasis is to be placed on products for ISDN [Integrated Services Digital Network].

This agreement, with a term lasting to the year 2000, provides that in manufacturing ISDN products a common architecture is to be used, on the basis of the interface IDM(TM)-2.

Siemens, AMD Cooperation

36980362 Munich EEE in German 21 Jun 88 p 7

[Text] Advanced Micro Devices, Inc. (AMD) and Siemens AG, Berlin/Munich, have agreed on an extensive cooperative effort in making integrated circuits (IC's) for telecommunications and data transmission. The emphasis lies on a common chip family for the "Integrated Services Digital Network" (ISDN). AMD and Siemens are offering circuits with which even now subscriber's units and switching equipment for ISDN can be produced.

The two manufacturers follow a common architectural line—IOM-2 interface. The cooperation of the two module suppliers for ISDN will accelerate the introduction of ISDN systems, because now two independent sources for supplying compatible circuits worldwide are being created.

The contract, drawn up for a period of 12 years, obligates AMD and Siemens to reciprocally function as a second supplier for the ISDN products of its partner. The arrangement is based on 15 already available ISDN chips, most of which come from Siemens.

In the next few years AMD will bring about a balance in IC's for data communication and for networks.

The agreement continues a cooperative arrangement between the two firms that has lasted for 10 years and is regarded as successful, with it being characterized by over a dozen separate contracts already for microcontrollers and peripheral IC's. AMD and Siemens have agreed to fabricate their ISDN products using a common architecture—IOM-2 interface. The two companies want to manufacture an identical chip assortment and jointly define and develop future ISDN products, in order to keep within bounds the expenditures for research and development.

Dr Hermann R. Franz, member of the managing board of Siemens AG and head of the components division: "At Siemens, telecommunications is one of the core areas of business. Consistent with this, we have given top priority to digital communication and especially to the design and development of innovative ISDN IC's. The IOM-2 architecture and the requisite IC's have been developed in close cooperation with producers of information systems, with Siemen's multifaceted knowledge of systems having been brought to bear as well. This cooperation between the two leading manufacturers of

communications modules is a contribution to Siemen's global ISDN strategy and is aimed at establishing an industry standard with the IOM-2 architecture. The alliance of AMD and Siemens reduces the join-up risks for the manufacturers of ISDN systems, because a wide range of the needed ISDN components are to be available through a second supplier as a backup."

W. J. Sanders III, chairman and chief executive officer of Advanced Micro Devices: "We are now at the threshold of revolutionizing voice and data communication. AMD and Siemens are becoming leading suppliers of circuits for the world network within ISDN and in equipment for data communication. The partnership of the two technology pioneers is a significant contribution toward transforming global communication."

The IOM-2 interface is an upwards-compatible expansion of the present IOM architecture and also tallies with the module architecture that the AMD is to be using in the future.

Philips, VLSI Agreement

36980362 Munich EEE in German 21 Jun 88 p 8

[Text] Philips of Eindhoven and VLSI Technology of San Jose have concluded a contract on a future cooperative effort in the area of application-specific integrated circuits (ASIC's). The contract includes the exchanging of design software, the providing of production capacities, and the exchanging of gate arrays and cell libraries.

"Through this contract each of the two companies will profit from the strengths of the other," said Cees Crijgsman in Munich before representatives of the European trade press and employees of the two companies. Crijgsman is president of the Philips IC organization. Under his leadership are its European activities, including the Submicron Project—carried out jointly with Siemens—and the fabricating of IC's in Eindhoven, Nijmegen, and Hamburg.

Philips produces a broad range of applications-oriented circuits, including the kind of IC's that are used in products of widespread popularity. CDI—Compact Disc Interactive—ECCT—Enhanced Computer Controlled Teletex—and ISDN are the products and systems that call for high-performance IC's. The standardization of complex systems makes it possible to integrate subsystems by means of ASIC's, and it is precisely against the background of a growing terminal-device market that this puts the manufacturers in a position to bring complex products into the market. At present numerous designs are being implemented in terms of 1.5-micron CMOS technology involving two metal layers. Plants available for this work are in Nijmegen and Hamburg. Moreover five ASIC design centers as well as seven technical support centers are providing the needed support to the European customers. Philips' European sales in ASIC's amount to about $20 million and are generated exclusively by chips of the low-complex technologies.

As the largest European IC supplier and a capable partner for analog, digital, and standard-logic products, Philips would like to expand its application-specific activities and become one of the largest European ASIC suppliers as well. Cees Crijgsman regards one means of achieving this goal as lying in a cooperative effort with VLSI Technology.

VLSI Technology Inc. is a leading developer and manufacturer of ASIC's, memories, and logic circuits. VLSI employs about 1,350 workers worldwide and in 1987 had a sales volume of DM [?] 172 million. The European VLSI Technology GmbH has its offices in Munich and has development centers and marketing organizations in Paris and Milton Keynes/Great Britain, as well as a European research center in Sophia-Antipolis in France.

VLSI has at its disposal a 1.5-micron gate array family with up to 50,000 usable gates. Another family with up to 65,000 usable gates is geared to employment in high-performance and density applications. The 1-micron gate array family is still in the development stage. Its introduction can be expected by the end of this year. The extensive cell library of VLSI includes about 280 logical elements and numerous megacells.

"We are pleased that after a comprehensive study Philips has chosen none other than our own IC development software and our competence in the field of gate arrays. This underscores the quality and strong points of our products," declared Alfred J. Stein in Munich. Stein is chairman of the board of directors and spokesman for the managing board at VLSI.

"Our ASIC technology and product line have already been very successful in Europe. This association with the largest semiconductor manufacturer and user in Europe not only confirms our abilities but also expands our market opportunities," states in this regard Dieter Mezger, VLSI vice president for Europe, with offices in Munich. He is hoping for not only greater market chances, but also a stronger product presence. Moreover he declared that from a certain level of sales on, one must be able to present to the customers manufacturing capacities in the European area or else second-source suppliers, and so in the future VLSI will be profiting from its cooperation with Philips.

Therefore VLSI Technology's strategy is based on the strength of its IC design software tools and its excellent semiconductor processes, in particular for ASIC's. Application-specific memory products are of use to the company above all in further process development and in the expansion of its know-how for making rapid RAM

compilers for the ASCIC's [sic]. ASIC-specific logic products provide the functional elements. Elements and tools together satisfy the requirements of the customers.

In detail, the contract provides that VLSI will use the Philips production facilities worldwide. VLSI is thinking about fabricating roughly 10 percent of its needs in Philips plants. VLSI has at its disposal an extensive, excellent IC design software, which is to be made available to Philips.

VLSI will also give licenses of its software to interested Philips customers, including users within the Philips company itself. Furthermore, the contract also provides that Philips will make available to VLSI its diffusion-related customer service, and in fact beginning in the second half of 1988 with the 1.5-micron technology.

VLSI will give to Philips a license to all elements of its present 1.5-micron ASIC product library. The two companies will be exchanging on a reciprocal basis their libraries for 1 micron and lower.

Philips will present itself as the second supplier of the VGT gate array series of VLSI, the VGT-100 family using 1.5-micron arrays with 9,000 to 50,000 usable gates, and likewise the recently introduced VGT family that offers up to 65,000 usable gates. Philips will also offer itself as a second source for the next generation of 1-micron arrays of VLSI.

CMOS-ASIC's are the strongest growing product group in the FRG within the IC market. With an average annual growth of 31 percent, in 1991 they will reach a market volume of about DM 380 million. In 1987 the market had a volume of only roughly DM 130 million. The most important market segments here are data technology and telecommunications. According to Walter Conrads of Philips/Valvo, just a few large systems manufacturers represent somewhat under half of the total market in the FRG. He says that this clientele in particular needs ever more complex ASIC's because of its steadily continuing system integration. Conrads, head of the microelectronics division at Valvo in Hamburg, expects that the proportion of complex ASIC's—those with more than 10,000 gate functions—will increase from 15 percent to 35 percent by 1991. In order to give optimal support to these German customers, Philips-/Valvo and VLSI Technology is offering a comprehensive infrastructure for the development of ASIC products, libraries, and software.

12114

Plans Continue for Philips-Siemens JESSI Chip Project

Separate Budget Item

36980358 Rotterdam NRC HANDELSBLAD in Dutch 22 Jun 88 p 11

[Text] Rotterdam, 22 Jun—Minister of Economic Affairs De Korte wants to ensure government support of Philips for a new chip project by creating a separate budget item for it beginning next year. It is expected that support will total at least 200 million guilders over 5 years.

Minister De Korte will propose the separate budget item this afternoon in a speech on this matter to the Second Chamber.

According to a letter written by De Korte to parliament, Philips has informed the minister that it would prefer to receive subsidies for several large projects instead of continuing to submit (smaller) applications for the "normal" pool of subsidies. The minister "welcomes this approach" and says that Philips has been acting this way this year already in anticipation of a favorable decision on the new funding for the chips. In reality, this means that Philips, in exchange for its "own" budget item, promises to no longer monopolize part of the other subsidies.

The minister did ask Philips to make a special effort to involve other Dutch companies and research institutions in the technology projects. Philips has indicated its willingness to do this. On 7 July, Philips will organize a presentation for other interested companies.

The chip research project in question, known as JESSI, is a follow-up to the current megachip project being carried out by Philips, together with the German firm Siemens. That project, which was approved in 1984, has been supported by the Netherlands to the tune of 200 million guilders, while the FRG has put in DM 300 million. The research is oriented towards developing a one megabyte chip with structures smaller than one micron (one millionth of a meter), and it ends in mid-1989.

Philips and Siemens again play the leading roles in JESSI, although the overall project will be much broader. In addition to the further miniaturization of submicron technology, JESSI will focus in particular on production techniques for the new chips, production equipment, materials and applications of the new chips. Parts of the project themselves to involvement by other companies as well as educational institutions.

According to a spokesman from Economic Affairs, however, Siemens and Philips can also emphatically exclude companies from certain elements of the project. This means that the two companies will be able to successfully resist the efforts by their French-Italian competitor, chip manufacturer SGS-Thomson, to participate in JESSI. The French recently issued a sharp protest against the course of affairs when it became clear that Siemens had no desire to involve them in the main research activities.

In his letter to the Second Chamber, Minister De Korte warns that "we must make sure that others who are possibly not involved in the project are not able to block decisions." The minister thinks that as a result, JESSI

should not start out entirely under the EUREKA European technology program. In addition, Philips and Siemens will be able to keep certain research results secret.

The exact amount of the Dutch subsidy for JESSI will be decided at the end of this year. The entire project costs around four billion guilders, of which Philips is responsible for one billion guilders. Over the coming months, a commission consisting of Philips, Siemens and two research institutions (the Dutch Foundation for Technical Sciences [STW] and the German Fraunhofer Institute) will be drawing up a five- year-plan for JESSI.

The Dutch representative on this commission for the STW is Dr C. Le Pair. He says that he is happy that the Netherlands is taking the time to properly work out the plans. A paper is to be presented next week in the FRG in order for the subsidy decision to be made.

Le Pair is "reticent" about the German plans to set up a separate research institute for JESSI in the FRG. "But it's their money," he says. He will resist plans for a central body in Germany if the result of that is that some things can no longer take place in the Netherlands.

30 Million Guilders From Dutch Government

36980358 Rotterdam NRC HANDELSBLAD in Dutch 23 Jun 88 p 11

[Text] The Hague, 23 Jun—Philips is to receive 30 million guilders this year as a subsidy for the new chip research that it is carrying out together with Siemens, the total cost of which is in the billions.

Yesterday, the permanent Chamber Commission for Economic Affairs adopted the proposal to subsidize a preliminary study as early as this year. Generally, subsidies for preliminary research amount to half of the total costs.

The project itself, known as JESSI, will start up in 1989, and is expected to require 200 to 300 million guilders in subsidies over the course of 5 years.

However, the spokesmen for all the parliamentary caucuses made it clear that the fact that the subsidy for the preliminary study has been awarded does not been that any decision has been made about subsidizing the ultimate project. An official decision on that will not be made until the end of the year, once the preliminary study has been concluded.

"At that time, the point of no return will have been reached," as CDA representative Van Iersel said. "That point is not here yet."

One absolute requirement set by the Chamber for subsidizing JESSI is that Philips extensively involve Dutch companies and research institutions in the chip project. Minister De Korte promised that Philips will make the necessary efforts to get others involved. "We must have that clearly in sight before we begin with the project," the minister said.

According to PVDA representative Van Gelder, the government must tell Philips to "bring it to a halt" as soon as it appears that there are too few parties in the Netherlands interested in participating in JESSI. Van Gelder also sees something inherently good in a role for Philips as a "booster" of technology projects in smaller companies, using subsidies.

There was pointed criticism from the VVD and PVDA about the tendency for Philips to terminate more and more activities in the Netherlands. VVD spokesman L. Rempt-Halmans de Jongh wondered whether the Dutch government should even give Philips so much support, considering the fact that Philips' home base in our country (six percent of sales) is increasingly narrower. Referring to Philips' international character, Rempt said, "What should we do if Philips is unable to place one bit of the results of this research in the Netherlands?" Van Gelder also expressed his concern about employment with Philips in the Netherlands.

According to Minister De Korte, there are currently around 10 companies in the Netherlands that are interested in taking part in the project, from automation firms to equipment suppliers. The former vice president of Philips, Dr Pannenborg, has been asked to seek out more interested parties. Philips is organizing a presentation on 7 July.

De Korte says that he has reached agreements with his West German counterpart, Minister Riesenhuber, to the effect that the FRG government will make demands of Siemens with respect to participation by third parties that are identical to what the Dutch cabinet is doing with Philips. Beginning next year, De Korte wants to put the Philips subsidy in a separate budget item. In exchange, Philips has promised to no longer make use of existing subsidy provisions.

According to De Korte, JESSI is necessary in order to "be able to reap the fruit" of the chip project now being carried out by Philips and Siemens. In the current megabyte project (supported by a half a billion guilders from the Dutch and West German governments), a megachip is being developed. JESSI will involve production techniques for making the chips as well as applications.

The new project will consist of four subprojects: production technology, equipment and material, chip applications and scientific research. According to De Korte, JESSI is much to big to fund it from the normal subsidy pools. A good deal of the money for JESSI will be used for EUREKA research.

Philips Sets Conditions for JESSI Participation

36980359 Rotterdam NRC HANDELSBLAD in Dutch 8 Jul 88 p 11

[Article by Eefke Smit: "Collaboration on Philips New Chip Project Does Not Appear Simple"]

[Text] Delft, 8 Jul—Dutch companies that want to work together with Philips in the new heavily-subsidized JESSI chip project will have to invest between 1 and 20 million guilders each in the project on their own. It is possible that the investments will not yield profits and returns until later, in other activities.

Companies that want to become serious suppliers to the chip industry after completion of the project will have to approach that task on a global level and be able to provide 24-hour service worldwide, for example.

This was the message from project leader R. Hamersma of Philips to around 20 companies who were gathering information about the next Philips chips project, which that firm is defining together with Siemens. The minister and the Second Chamber are willing to subsidize the project to the tune of 300 to 500 million guilders, provided that Philips allows an adequate number of other Dutch companies to participate, so that the results of the project can benefit the entire Dutch economy.

However, Hamersma made it clear yesterday in Delft that these demands are too great. "You should not overestimate electronics," he said. "For each guilder in sales, there must be one guilder in investment."

The member of the Second Chamber present, Ms L. Rempt-Halmans de Jongh, was "not happy" with the presentation. "I understand now that the companies that want to participate have to have a great deal of know-how. And that it is in fact only the 'big boys' who are interested. In the Chamber, we simply expressed the desire that Philips take smaller companies by the hand and pass on to them chip know-how."

There was also skepticism here and there on the part of the companies present about the possibility of participating. In particular, the submission date for completed proposals (17 August) was met with criticism. In addition, some found the aura of secrecy surrounding more specific information about the subprojects less than inviting.

A representative from the chemicals producer DSM wondered what would come of investments by Dutch companies if, after the conclusion of the project, Philips were to go off to Asia to produce the chips and also get its raw materials there. "If you scamper off to the Far East, we're stuck," he said.

Project leader Hamersma of Philips suggested that it would be good for the companies present if they were to try to qualify on the world market as well. "It is your own business to want to be the best. But Philips would like to help you at it. It is important for Philips to have good suppliers close to home. And wherever we can, we want to help you sell in Asia as well. Your success is also our success."

Participation by other companies, which was set as an absolute precondition for the subsidy, is being sought in three areas: materials and production equipment (suppliers), applications of the chips (buyers) and scientific research (universities and laboratories).

The heart of the entire project, miniaturization technology for producing submicron chips (chips with structures smaller than one- millionth of a meter) is being conducted by Philips together with the German company Siemens. The exclusive character of this cooperative arrangement was sharply criticized recently by the French-Italian company SGS-Thomson. According to Hamersma, however, SGS-Thomson's participation in that component of the project will be announced in August or September. "But negotiations are still under way."

According to Hamersma, it was never the intention to completely exclude SGS-Thomson. But when the two partners, SGS and Thomson, merged last year, "they simply did not have any time to think with us about the JESSI chip project." Siemens and Philips then continued to devise the project "because we cannot afford any delays."

The focal point of the project is an effort to make chips with submicron structures of 0.3 microns in 1996. The production of these chips must become cheaper and more reliable, and Europe must become independent of Japan and the United States in supplying equipment and raw materials.

The total project, which will run until 1996, will cost around four billion guilders, two billion of which will be covered by Siemens, with Philips putting in one billion. The Dutch government will provide subsidies of 300 to 500 million guilders if Philips is able to mobilize an adequate number of other Dutch participants. That remains to be seen on 17 August.

Swiss Assessment

36980360 Zurich NEUE ZUERCHER ZEITUNG in German 16 Jul 88 p 11

[Text] Brussels, 14 Jul—The Dutch government is willing to provide financial support for the new Philips-Siemens microelectronics project, known as "JESSI." This research and development project is in part a follow-up to the megaproject, through which the two companies wanted to move into a worldwide leadership role in chip production. In a letter from Dutch Minister of Economic Affairs Rudolf de Korte to parliament, he said that for the time being only the planned feasibility study and subsequent preliminary research would be

supported; however, there are already signs that the state will give Philips a hand financially during the project itself, which is planned for the period from 1989 to 1995. There is an aura of secrecy surrounding the subsidies that the Ministry of Economic Affairs has already promised Philips. Neither the ministry nor the company is willing to name figures. The total cost of "JESSI" is being estimated at four billion guilders, of which around one-quarter will be covered by Philips.

Criticized Subsidies

In the FRG in particular, the generosity of public financial support for the megachip project has elicited criticism. One-third of the total cost, which amounts to approximately 1.5 billion guilders, was assumed by the Dutch and West German governments. Many observers viewed the public assistance as a pure gift, since both companies could have realized their project without public support. Apparently in anticipation of similar objections, De Korte emphasizes in his letter that "JESSI" will also be open to other companies, and will thus contribute significantly to the development of research and production in the area of microelectronics. In view of the amount of state assistance expected between 1989 and 1995, he says, Philips could be required to make a special effort to involve other companies. On the other hand, however, De Korte notes that no decision has been reached about the awarding of subsidies after 1989. In addition, the project should not, at least for the time being, be placed within the framework of the EUREKA cooperative European research project, since this would bring with it the danger that outsiders would gain influence and be able to block decisions. In contrast, Philips wants as many European partners as possible, if for no other reason because "JESSI" is expected to cost more than twice as much as the megaproject. For its part, Siemens has hesitated for some time to invite SGS-Thomson to get involved.

Transition to Industrial Production

Although the first megachip was unveiled a year ago, the Philips- Siemens joint project is far from over. Researchers in Eindhoven concede that one of the most difficult tasks is preparing for industrial production. But that has yet to be done. In this regard, "JESSI" is the follow-up to the megaproject. One of its goals is to set up cheap and reliable mass production of these chips on the basis of the submicron technology that has been developed. In this regard, a separate goal that is being pursued is to develop an independent source for the equipment and materials needed for this production. Europe is to become independent in terms of production facilities, so that it is able to produce at prices that are competitive on the world market.

"JESSI" is also supposed to help in the development of methods for computer-aided design (CAD), so that chips produced using submicron technology can be applied in all possible sectors of the economy. This should benefit users in particular, who in this way can count on shorter development schedules for their products. Not least of all, however, the road towards even finer submicron structures is to be found within the framework of "JESSI." Philips says that by 1993 it is possible that structures of 0.5 microns will be achieved, with 0.3 microns coming out as of 1996.

The Dutch minister of Economic Affairs points out in his letter to parliament that Philips is the largest European producer of chips. Thus, the Netherlands has a special amount of responsibility with respect to achieving a greater degree of independence from non-European suppliers, who still account for two-thirds of the European demand for chips. On the other hand, he notes, the Netherlands can for this reason also count on more positive side effects than other countries. Concrete benefits here would be felt by companies that, through "JESSI," could get a jump on others in applying submicron technology.

12271

Siemens Produces More 1-Megabit Chips Than Expected

36980361a Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 20 Jun 88 p 8

[Text]Siemens Inc is reporting an extraordinarily positive production development in the manufacture of its 1 megabit memory, representing billions of investment. Since the beginning of deliveries in January 1988, 1.5 million 1 megabit chips are supposed to have been transferred to customers. By September 30, 1988, sales of 3.5 million units are expected. Karlheinz Kaske, chairman of the board of Siemens Inc, figured expected sales at the beginning of 1988 at 2 million units.

The Regensburg Siemens plant, which is associated with the components area, supposedly reached a monthly production of about 1 million megabit chips in the last quarter of 1988, according to available data. The start of production was originally delayed. Siemens intends to invest about 2.7 DM into the megaproject—for development and production of 1 and 4 megabit chips. Up to now more than 1.1 billion DM have been expended for the Regensburg plant as well as for the Microelectronics Center in Munich-Neuperlach.

This caused the components area—which, with 2.8 billion DM sales, contributed 4 percent to total sales in 1986/1987—to be the only business area to close in the red for 1986/1987. Siemens production of the 256 kilobit chips in the Austrian Villach also supposedly was considerably expanded. The previous year's output of barely 6 million units would triple in the current year. The Regensburg Siemens plant is currently the only production facility outside Japan which delivers 1 megabit chip

not only for in-house use but also for the market. Considerable price increases have recently been recorded for chips, as a consequence of increased market demand.

08348

NUCLEAR ENGINEERING

Status of FRG, European Research on Nuclear Fusion Compared

3698m451 Bonn TECHNOLOGIE NACHRICHTEN-PROGRAMM INFORMATIONEN No 425, 6 Jun 88 pp 2-16

[Excerpts]

I. Preliminary Remark on Fusion Research in General

1. Potential and Basic Problems of Nuclear Fusion

It is the goal of fusion research to fuse hydrogen nuclei in a controlled reaction and to make the large amounts of energy thereby released available for utilization. The most promising method for physical reasons is the fusion of deuterium (D) and tritium (T). While deuterium is found in practically any amounts since it is a component of water, tritium must first be artificially produced during the fusion process by irradiating lithium with neutrons. The initial materials in the first fusion reactor will thus in all probability be deuterium and lithium.

The distant goal of fusion research, however, is to fuse deuterium with deuterium, in order to become independent of the lithium/tritium breeder process. The reaction threshold for this is more than a factor of 100 higher than for the D-T reactions. However, if it is possible to reach this threshold, fusion would make available a source of energy which lasts forever.

Another series of fusion processes based on the reaction of D + ^{3}He or on the process consisting of protons +^{11}Bo which produces ^{4}He nuclei are even more difficult technically. According to estimates today, the D-T process is closest to technical realization.

Scientists differ as to the time frames for achieving the goals. They vary from 20 or 30 years for the first D-T demonstration reactor to 50-70 years until the final D-D reactor, with an additional 20 years until commercial use. The reasons for the long time spans—in comparison with nuclear fission—between the first basic research and potential commercial exploitation for fusion lie primarily in the complicated physics of the plasmas. The equations which form the basis are extremely complex and strongly non-linear, as in meteorology, for example. In comparison, nuclear physics, which was necessary in order to develop nuclear fission reactors, is simple.

In nuclear fission it was above all the development of the technology which needed a great deal of expense and not the physical research. This second step, that is to say the development of the technology, still lies ahead in the volume necessary for fusion. An extensive foundation for this is for the first time to be laid within the European framework with the new 1987-1991 Fusion Program (technology portion) (see also TECHNOLOGIE NACHRICHTEN-PROGRAMM INFORMATIONEN No 412, 23 Nov 87). To be sure, in many areas fusion will be able to profit from the developments of nuclear technology. This was one of the reasons for the involvement of the KfK [Karlsruhe Nuclear Research Center] in this field.

2. Physical Development in the Last 20 Years

In the discussion about fusion research the so-called Lawson criterion plays a central role. The following circumstance is the reason for that: In order to be able to fuse the hydrogen nuclei they must be brought together for a sufficiently long time in such a manner that they come as close to one another as possible. This latter problem can be solve in two ways, in principle:

Inertial Confinement

A strong compression for a brief time can be achieved through energy-rich radiation (laser) or through particle bombardment. Because of the inertia of the reacting particle, there is a short but finite time in which the D-T reaction can take place, before the He and the neutrons expand. It is in this respect not a matter of a genuine inclusion, but the density is set so high that the D-T mixture is able to burn up nearly completely.

*Magnetic Fusion*By means of a greatly heated plasma the high speed of the nuclei resulting from this is utilized in order to allow them to fuse into one another in order to overcome the electrical repulsion (plasma fusion, in short: fusion). Since the collision of the hydrogen nuclei takes place only statistically, a sufficiently large number of nuclei (= n particles/cm^{3}—at least 100 x 10^{12} He nuclei), which remain together for as long as possible (= t seconds—at least several seconds) at the high temperature (= T°Kelvin—at least 100 million °K). The Lawson criterion establishes the minimum values for the product n x T and the temperature T in order to produce more energy in a plasma than was added in order to heat it until ignition.

The attached diagram (Appendix 1) shows how the development in time of fusion in the last 20 years has progressed in order to reach the Lawson criterion. It also shows that with the first operational dates of the JET [Joint European Torus] as well as the U. S. TFTR at Princeton scientists have taken yet another major step closer to the Lawson criterion. The development from 1965 to 1985 has bridged a gap of 4 orders of magnitude

for the n x t product. Similar successes have been recorded in achieving the necessary temperatures, where now only a factor of 5 remains in order to meet the Lawson criterion.

With respect to energy extraction, magnetic fusion is in the foreground. Research projects on inertial confinement in Europe are limited exclusively to basic physics and to less than 2 percent of the total spending on fusion.

3. Key Physical Problems

In the following, the most important physical problems will be briefly examined which in the medium term are the object of major research projects.

a. Energy Confinement Time: In order to fulfill the Lawson criterion, a sufficiently high temperature is needed (about 100 million degrees). For this, currents must be brought into the plasma as well as energy by means of external heating. It must then be confined in the plasma sufficiently long (on the order of second) in order to cause the ignition of the plasma. The energy confinement time can be expressed in simplified form as

Energy confinement time = thermal isolation value x R^2

R is for instance the radius of the vessel in which the plasma is enclosed, and is therefore given by the pure size of the facility. Since this value enters with the square, this gives one of the significant bases for the progressive size of the fusion experiments. The equation also shows, however, that the thermal isolation value cannot be improved at will, meaning even the experiment must have somewhat the same geometric dimensions as the future demonstration reactors, entirely in contrast to nuclear fission. This makes the experimental phase so disproportionately expensive.

The final magnitude of R depends decisively on how good the thermal isolation can be, that is to say how long the added energy can be kept in the plasma before it flows off to the outside. This parameter contains nearly the entire complex physics of the plasmas, and here is where physical surprises are constantly possible, such as the discovery of the so-called H-regime in 1983 by the IPP [Max Planck Institute for Plasma Physics]. With that, a plasma condition with particular thermal properties was found which was not predicted theoretically.

b. Plasma Purity, Plasma-Wall-Reciprocal Action: The quality of thermal isolation includes among other things the purity of the plasma as an essential factor. Impurities coming for example from the wall of the vessel contribute very sensitively to the rapid transport of heat from the interior of the plasma toward the outside.

Two methods are being studied as a technology to keep the plasma pure: diverters, which in practice act as vacuum cleaners, and pump limiters, which essentially consist of special discs which peel off impurities at the edge of the plasma. Diverters are being studied at IPP in the ASDEX and—on a larger scale—the ASDEX Upgrade experiments; pump limiters are studied by TEXTOR in Juelich. Both machines, to be sure with different objectives, simultaneously also examine the complex processes in the reciprocal action between plasma and wall.

c. Heating: Except for the plasma current inherently occurring in Tokamak, which causes the plasma to heat up (ohmic heating), there are several different methods of adding energy to the plasma from outside: radio waves or the inclusion of high-energy particles. Althogether, at the present five different types of heating have been developed around the world as well as in Europe and experimentally tested in varying sizes:

High-Frequency Heating Methods

- Electron synchrotron resonance heating
- Ion synchrotron resonance heating
- low hybrid wave resonance heating
- Alpha-wave heating

Neutral Particle Injection Heating

The methods are extraordinarily difficult technologically, and their most important components are being developed by industrial companies (such as Siemens, Valvo, Thompson). A quite decisive element in this development are facilities which are able to give off high-power impulses over longer periods of time (many seconds).

d. High Magnetic Fields, Beta Limits: The magnetic fields which are being used at the present time in fusion equipment are not yet powerful enough. While the development of stronger, larger, superconducting magnets is a subject of the technology program, the physical behavior of plasmas with high magnetic field strengths is the subject of additional physical research. Another critical point in this context is the question of what size can be achieved for the relationship of external pressure by the magnetic field to the internal pressure of the plasma. This relationship is called beta and is essential for the later design of a reactor and thus its economic efficiency.

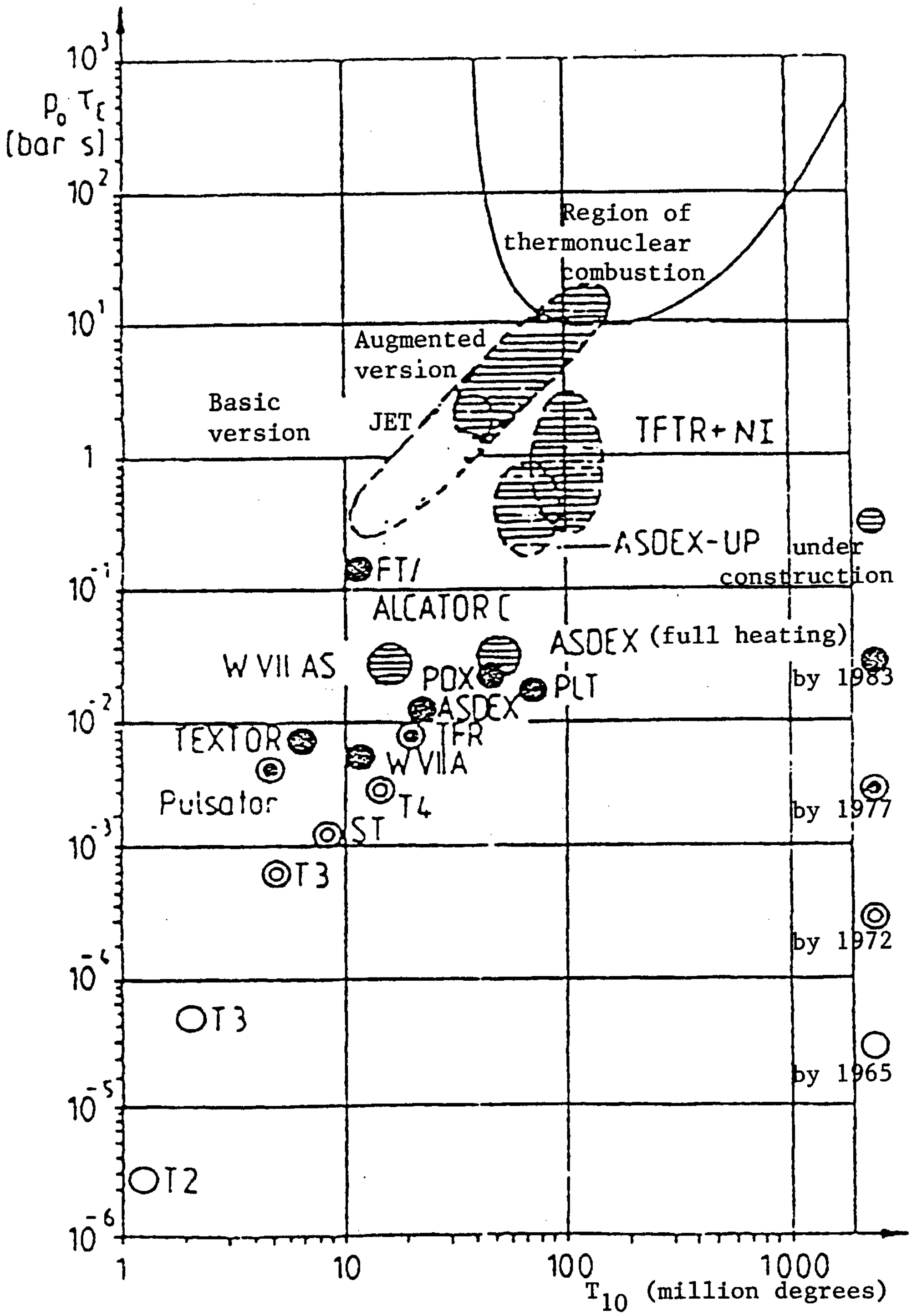
4. Key Technical Problems

Because of the high degree of difficulty of the physical problems, fusion research up to now has focused almost exclusively on plasma physics. The resulting accomplishments make it possible to achieve the Lawson criterion and thus the ignition of a plasma for the first time within the not too distant future.

For this reason, studying the technical problems of a fusion reactor are gaining increasing importance. Key problems in this area are:

- Material development and design of the first wall, meaning the wall turned toward the plasma.

Appendix 1.


$p_0 \tau_E$ [bar s]
Region of thermonuclear combustion
Augmented version
Basic version
JET
TFTR+NI
ASDEX-UP
under construction
FT/
ALCATOR C
ASDEX (full heating)
W VII AS
POX
PLT
ASDEX
TEXTOR
TFR
W VIIA
Pulsator
T4
ST
T3
T3
T2
by 1983
by 1977
by 1972
by 1965
T_{10} (million degrees)

Material development and construction of the blanket, meaning the vessel structure below the first wall, in which the neutrons are caught and transformed into energy and from which the energy is then diverted for use. Furthermore, lithium must still be pumped around in the blanket, so that a sufficient quantity of tritium can be produced in the neutron radiation.

Safe processing of large amounts of tritium.

Remote servicing of large, radioactive structural materials.

Development of very large superconducting magnets in order to produce high magnetic fields.

The experience gained in nuclear technology can be used in several of these areas; this applies primarily also to the analyses of hazard and safety factors developed there. The development of materials that can stand up to high neutron radiation and stress loads (fatigue, creeping) and the production of superconductors represent a particularly great challenge.

These material questions and the development of a suitable blanket, a practicable lithium-tritium cycle as well as large superconducting coils and the corresponding handling technology are the object of the Karlsruhe Nuclear Research Center's fusion technology program.

5. Alternative Containment Concepts

In plasma fusion principally two geometries for containing the plasma are being studied: Linear and toroidal arrangements, While there are only a few variations for linear arrangement (such as reflecting machines), there are many different possibilities of toroidal arrangement. The so-called Tokamak containment, developed in the Soviet Union, has turned out to be particularly promising in the medium term. JET and the U.S. TFTR, as well as the Japanese JT 60 are Tokamaks, as are in Germany ASDEX, ASDEX-Upgrade (IPP) and TEXTOR (KFA [Juelich Nuclear Research Center]). Of the many alternatives to Tokamak, in contrast to the United States only two are being pursued in Europe: The Stellarator with the Wendelstein experimental series at IPP (at present Wendelstein VII AS under construction) and a Spanish Stellarator experiment and the Reversed Field Pinch with a large experiment under construction in Padua, in which Great Britain is also participating. Stellarators enable continuous operation. Tokamaks can only be operated in pulses.

II. The European Program; Comparison With Other Programs

1. Organization

The EURATOM fusion program is supported by the European Community countries as well as Switzerland and Sweden, concentrating on research work within the "associations" of the member nations and the operation and utilization of the "Joint European Torus" (JET) in Culham. In the JET Europe possesses the largest Tokamak facility in the world at this time. The Tokamak, which began operation in 1983 after 5 years of construction, is, based on its design, intended to get very close to the ignition condition and thus provide significant information about the behavior of plasmas with high density and temperature. The full design parameters were reached in the ohmic heating phase (5 MA plasma current, 2.5 Tesla magnetic field) and plasma temperatures of 35 million degrees Kelvin were measured with the best confinement times of 0.8 s in the world. In 1985 the ion cyclotron resonance heating could be taken into operation with a capacity of 5 MW. Approximately the same heating efficiency could be achieved with both heating methods. The plasma temperatures thus rose to about 60 million degrees Kelvin. Both methods are to be expanded in the next expansion step to 15 MW high-frequency heating and 10 MW neutral particle heating. The JET research program is led by the JET council, to which all members of JET and the European Community Commission belong.

The JET research program is accompanied by an approximately equally extensive project program in the associations. The most important Tokamak experiments are represented in Appendix 2.

Appendix 2. The Most Important Tokamak Experiments in the Euratom Program 1985-89

Experiment	Association	Research subject	Initial operation
JET	Cooperation by all associations at Culham (GB)	Plasma physics in the vicinity of ignition	1982
TEXTOR	KFA Juelich (FRG	Plasma-Wall Effects	1982
ASDEX-U	IPP Garching (FRG)	Divertor plasmas with reactor-specific configuration	1987
TORE-SUPRA	CEA Cadarache (F)	Plasma heating in long pulses, power production	1987
FTU	ENEA Frascato (I)	Plasma physics with high densities and high temperatures	1987
COMPASS	UKAEA Culham (GB)	Plasma stability with high plasma pressure	1987

The German fusion program is part of this Euratom fusion program and is therefore also largely conducted and cofinanced by Euratom and the corresponding European advisory committees (Advisory Fusion Committee—CCFP—and its three subcommittees). Euratom's immediate influence on the national subprograms takes place through the so-called association contracts. In the case of the FRG, these exist between Euratom on the one hand and the IPP, KFA and KfK, respectively, on the other. In France, for example, the national association partner is the CEA

[Atomic Energy Commission] and in Great Britain the UKAEA [U.K. Atomic Energy Agency].

Association contracts regulate, among other things, the influence on the form of programs for the centers and Euratom's financial participation. This amounts to between 25 and a maximum of 45 percent, according to whether so-called priority funding or just normal funding is granted the projects at the centers. In order to receive priority support, an experiment must pass at least two external, critical evaluations, almost exclusively undertaken by competitors for Euratom's money. All major German physics projects receive priority funding, as do a large part of the new KfK technology projects.

2. Strategy of the European Program, Comparison With the United States and Japan, NET Decision

The project goal for the new Euratom fusion program as well as its strategy are contained in the 1985-1989 program, which was approved in December 1984 by the council and whose—overlapping—continuation (1987-1991) is now being prepared. It will be briefly summarized in the following.

It is the goal of the Euratom fusion program to take into operation in about 40 years a first power-producing demonstration reactor, called DEMO. In order to reach this goal, after JET only a single major project, called NET (Next European Torus) is to be built as an intermediate step.

It will be the task of NET to serve primarily as an experimental facility for the development of fusion technology. This means that NET must already contain a controlled-burning plasma. In order to achieve that, either JET in its complete expansion must already have ignited (which had not been planned in the design, but now nevertheless appears possible), or JET must have advanced the physics of the fusion plasmas so far, that the ignition of plasmas in NET can be guaranteed.

This is a point where there is disagreement between physicists both in Europe and in the United States. While the majority of scientists are of the opinion that this is feasible, there is another group which believes that even after JET the physics will still be so unclear that the step of an NET is too risk-filled. They advocate an additional physics machine after JET (JET-Upgrade or ignition experiment) and only after that do they want to build an experimental facility for development of the technology. In this alternative strategy, NET would be separated into two steps. That would reduce the risk, to be sure, but would also be connected with considerably greater cost.

Initially, the United States wanted to take a route similar to that of the Europeans. Then another way was decided upon, in which all alternatives to the Tokamak studied up to now would be extensively developed. Recently, however, the TFTW Tokamak at Princeton has once again become the focus of the U.S. fusion program.

With the decision on the 1985-1989 fusion program in December 1984, Europe has deliberately first chosen the more risk-filled way. This is primarily for two reasons: First, scientists in Europe are of the opinion that significantly more is known about the physics than the pessimists maintain and that the program now being initiated in the research groups will deliver the missing information by 1989. Second, the participants are aware of the danger that—as in the past—fusion research very easily tends to turn into basic research and thus gain in intellectual breadth, to be sure, but lose in goal-oriented activity. This danger grows even more when 13 different states are participating. In order to counter this danger of frittering away the objective, the ambitious and quite risky strategy of a single step between JET and DEMO was chosen.

Just how long this can be kept up will be answered no later than the time when the decision is to be made whether to initiate a real development phase for NET. That may be the case as early as the next program revision in 1989/1990, or not until 2 years later, 1991/92.

In the long run, that is to say beginning in the early 1990's, such a decision is connected with considerable stockpiling of funds for fusion research in Europe, since the construction and operating costs of NET (for about 20 years) are currently estimated at about DM 5 billion, meaning an average of DM 250 million annually, which is as much as the FRG alone is spending on fusion research.

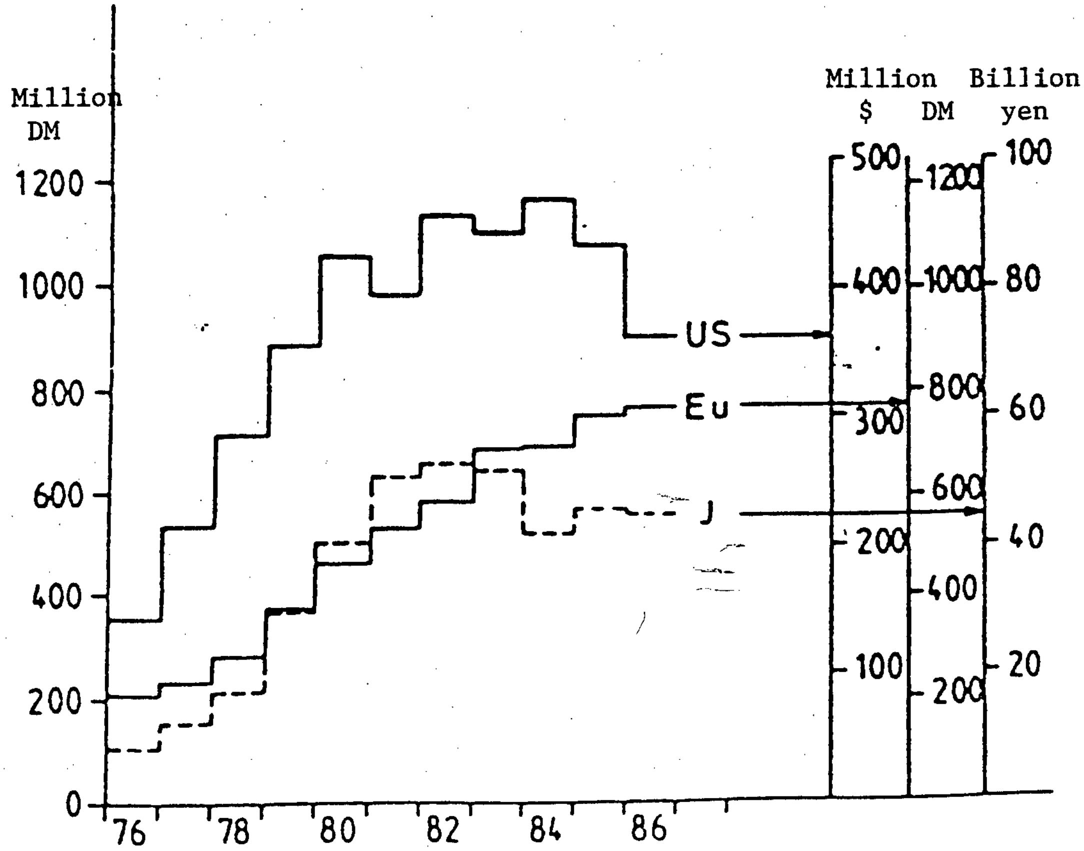
In comparison: The JET program 1978-1992—including construction and full operational costs—is estimated at DM 2 billion. Therefore, the decision about the NET design phase also becomes a decision whether the European fusion program should continue in this way or not.

It is an essential milestone in fusion research that plasmas can be brought to ignition temperatures only in very large apparatus. It involves a difficult and lengthy development, which is connected with great cost until it is ready to be used as a source of energy. This has led to there being only four major research programs worldwide which are aimed at fusion. These are the programs in Western Europe, the United States, Japan and the

Soviet Union. Fusion work is under way in other nations as well (in particular China, Canada, Australia), but they cannot be regarded as independent developments on the path toward a fusion reactor.

Based on financial size, the U.S. program is the largest, followed by Western Europe and Japan (Appendix 3). The financial costs in the Soviet Union are not known in

Appendix 3. Annual Spending on Fusion



Development of the annual spending for fusion in the United States, Europe and Japan. Due to the strong fluctuations in exchange rates, spending by the United States and Japan is given in the currency of each country. The varying scales are based on a ratio of 1 dollar = DM 2.5 = 200 Yen.

detail. Based on the number of experiments, however, spending in the USSR is certainly comparable or even greater than that of the other programs.

b. Japan

In 1982 Japan decided on a long-range plan for fusion development, whose goal is to demonstrate technical feasibility of fusion in a "Fusion Experimental Reactor (FER)". A step on the way to this goal is the large Tokamak JT 60, conceived by JAERI [Japan Atomic Energy Research Institute] in close cooperation with Japanese industry and brought into operation in 1985. Its plasma volume is about half as large as that of the JET, but it is not designed for tritium operation. By the end of the 1980's a 10-MW heating capacity from high-frequency radiation and 20 MW from neutral particle heating is to be available, with the objective of showing the "physical feasibility" of fusion.

In the first year of operation it was possible to reach the plasma parameters intended for the ohmic heating phase. In contrast to the other two large Tokamaks, JET and TFTR, the JT 60 has a divertor, which helps to maintain clean and stable discharges. This divertor encloses the discharge volume on the outside like a belt and is therefore different from the divertor used successfully at IPP. The planned additional heating systems will be operational in about another year.

In parallel with the preliminary work on an FER, JAERI is undertaking an extensive technology program in order to develop high frequency heating methods, superconducting coils, breeder materials (blanket) and structural materials. A tritium laboratory is under construction and is to be completed in 1988.

In addition to JAERI's work, a considerable amount of fusion research is carried out by the universities in Japan (particularly at Nagoya, Kyoto and Osaka). This research has so far focused above all on basic development of various confinement concepts (linear magnetic confinement, inertial confinement), further development of the toroidal confinement concept with respect to stationary operation, high beta, better confinement properties and compact construction (stellarator/heliotron, compact toroidal arrangements/Spheromak/Reversed Field Pinch). After a thorough examination of the program at

this time by various working groups, a concentration on helical configurations (stellarators or heliotrons, as the Japanese say) is anticipated. A joint inter-university research institute is being built in Osaka in order to undertake the work. c. USSR

Fusion research in the USSR is primarily centered around Tokamaks and stellarators, but linear mirror devices, compact toroidal pinch arrangements, plasma focus and inertial confinements are also being studied.

A multitude of smaller and medium-sized experiments are used. Experiment T-10, in the center of the program up to now, which began operation in 1975, has been shut down at this time. Its successor, T- 15, with superconducting coils, which corresponds to the TFTR in size, is still under construction and will be soon be completed. Considerable contributions are being made, primarily in the use of electron synchrotron wave heating.

3. Program Structure and Division of Work in Europe

According to the goals, the program consists of four major areas:

- JET;
- accompanying physics program with preliminary work on NET;
- technology program;
- study of two alternatives to Tokamak.

a. JET

The entire project includes the period 1978-1992, which is divided into the following phases:

- construction of the facility with its basic equipment 1978-1983
- Step-wise experimental operation 1983-1989
- Construction of additional heating 1984-1991
- Filling with tritium in 1988

b. The Accompanying Physics Program

The significant physical questions described here earlier are being worked on by the countries based on a division of labor:

- Keeping the plasma pure, plasma-wall-reciprocal action: IPP (ASDEX-ASDEX- Upgrade), KFA (TEXTOR)
- Superconducting torus, high-energy pulses of long duration: Cadarache (Tore supra)
- Behavior of plasmas during high magnetic field strengths: Frascati (FT, FT-Upgrade)
- Beta limits: Culham (Dite, Compass)
- Development of various additional heating and diagnostic methods: FOM (Netherlands) together with Fontenay aux Roses (France), Belgium together with TEXTOR, Ireland and Greece together with ASDEX, Riso (Denmark) together with Fontenay, Lausanne.

The physics program was given a new structure in 1982/83 and oriented toward the JET-NET-DEMO strategy. It runs until approximately 1989/90.

c. Technology Program

The technology program is only in its beginning. It is to be increased with the new Euratom 5-year program according to its needs. Due to the large cutbacks for the fusion program by the council in December 1984, principally the technology portion and the NET planning have been delayed. Work on the technology program as well is being undertaken on a divided basis in Europe:

- NET Team:

In order to avoid from the beginning a fragmentation in the development of technology, it was decided to orient the entire program toward an—initially ficticious—NET. For the purpose of defining the fundamental goals of an NET, in order to structure the technology program correctly and to act as a contact place for all technological developments outside Europe, the European NET Team (about 35 members) was founded in March 1983. This founding is based on an agreement between Euratom, the associated organizations, Ireland, Luxembourg and Greece. It is attached to the IPP and is headed by an Italian.

- Research group program:

The technology program essentially works on the previously described key problems as well as the body of safety and environmental issues. The work is also divided. Organizationally, the program was broken down into a multitude of individual tasks. These tasks were and are distributed in Europe, and the research groups can compete for them, whereby a very strict selection method is adhered to. For larger projects there are also cooperations between various countries.

In Germany the program is concentrated at the KfK, with emphasis on superconductivity, blanket development, tritium cycle and material research.

- Industrial research:

An even smaller part of the program at the present time is undertaken directly by industry and is financed directly by Brussels. At the moment it consists primarily of subjects in high-frequency technology (Siemens, Thomson) and superconductivity.

d. Alternative Concepts

Out of the multitude of concepts Europe has decided only to develop two alternatives to the Tokamak. These are the stellarator in Germany (Wendelstein, IPP) and the Reversed Field Pinch in Padua (Italy), which is to be built and operated in cooperation with Culham (Great

Britain). Both alternatives have the advantage, if successful, that they would allow continuous operation; in contrast to the Tokamak, which works in pulses. Of the alternatives the stellarator is so successful that in the long term is has a very serious chance of replacing the Tokamak. The possibility actually exists, and is included in the strategy discussions, that the DEMO could be not a Tokamak but a stellarator.

Japan, as well as to an increasing extent the United States, is working on a broad program of alternatives without as yet having managed to catch up with the development lead of the Europeans in stellarators and reversed pinches. The European successes have also led to the fact that stellarators have been included in the program in the United States, Japan and the USSR.

4. Assessment of the Program and International Comparison

—Assessment:

Both the European 1982-1987 fusion program up to now, and the new 1985- 1989 program have been evaluated in detail by scientists outside the fusion field. Both of these commissions were headed in 1981 and 1984 by Professor Beckurts. They confirmed the European strategy and recommended a funding volume of about 300 million ECU/year for the next few years, which is in agreement with the actual figures. (Appendix 3)

III. International Cooperation

International cooperation within the framework of the fusion program is- -for the German centers as well—essentially channeled through the following organizations:

1. IAEO

Several technical and physical themes are being worked on within the framework of the IAEO. The principal activities, however, are the large worldwide conference on fusion research by the European Physical Society, held annually, as well as the INTOR study. INTOR is a conceptual study for a facility similary to NET, on which Japan, the USSR, the United States and the Euratom program have been working for a number of years. Until the establishment of the ITER study group (see 4.), INTOR was practically the only official connection in fusion research between Europe and the USSR.

2. IEA/Paris

The activities of the OECD states are being discussed in the framework of the International Energy Agency. The IAE also provides the legal framework for a series of cooperations, in which joint projects are also being undertaken. Examples are the Large Coil Project (LCP) with participation by the United States, Denmark, Switzerland and Japan, or Textor at Juelich. Cooperation at major Tokamak experimental facilities (United States, Japan, Euratom) was agreed to in April in Garching. At this time there are six agreements of this type. The official partner vis-a-vis countries outside Europe is usually Euratom.

3. Worldwide Economic Summits

Fusion research is one of the subjects which was discussed in the framework of the Working Group for Technology, Economic Growth and Employment. The objective is to find new ways for the most extensive cooperation possible, with a division of the tasks, between the three programs. Talks within this framework have been fruitful up to now, and have, regardless of all the existing contacts between scientists, contributed to mutual understanding. The work is also being continued for the time being even after the group's final report.

4. Reagan-Gorbachev Initiative (RGI)

On the occasion of the summit meeting between President Reagan and General Secretary Gorbachev in November 1985 in Geneva, an agreement was reached to work together worldwide on thermonuclear fusion.

During a meeting on 19 October in Vienna, representatives of the European Community, Japan, the Soviet Union and the United States agreed to submit proposals for joint plans for an international fusion experiment to their governments. Following an offer by the Europeans, the Max Planck Institute for Plasma Physics (IPP) in Garching was chosen as the technical site for joint projects. The chairmanship of each of the three decision-making and advisory organs of the project is held by an American, a Japanese and a Soviet leader. The overall leadership of the project is held by the International Atomic Energy Organization (IAEO). It is the objective of the study phase, agreed to be for the next 3 years beginning in April 1988, to prepare jointly for an "International Thermonuclear Experimental Reactor" (ITER). The purpose of the work on these plans is for a decision at the end of 1990 whether and how—jointly or alone by the individual partners—the fusion experiment should be built and operated. The location of the experiment will also not be determined until this time.

According to the European plan, as long as a decision to build the ITER has not been taken, the European NET project will continue. In the event of a positive decision, construction of the experiment could begin in 1993, after detailed design work.

IV. The German Program

1. Overview

As was shown in the description of the European fusion program, the German program is fully integrated with Euratom and is thus a component of this program. By far the greater portion of the research is carried out by the three research centers IPP, KfK and KFA. Smaller

projects (materials research) are conducted by HMI [Hahn-Meitner Institute] and basic research on inertial fusion at GSI [Society for Heavy Ion Research] and the Max Planck Institute for Quantum Optics. In addition to the centers, there are numerous research projects at the universities.

2. Objectives

Although the German program is a part of the Euratom program, there is an independent strategy within this framework. It is primarily aimed at engaging key problems in fusion research, both in the physics and in the technology. This is in order that we should always be in the position of having an extensive overview over all current developments. This is why IPP is working on plasma purification with divertors (ASDEX and ASDEX-Upgrade) and KFA is developing the only alternative to it, the Limiter (TEXTOR). Plasma-wall reciprocal action is being worked on in a complementary manner by both ASDEX and TEXTOR. Further, the ASDEX is the first exeriment where IPP will operate all current heating methods simultaneously and thus be the only research institute to have the necessary experience in dealing with the combination of these technologies. In the area of alternatives to Tokamak, IPP, with its stellarator (Wendelstein experiments), is taking the route which today is considered the most promising in the world. In addition to the traditional superconductivity included when the European technology program was conceived in 1982, KfK has taken up the other key subjects of materials development, blanket and tritium cycle in its research program.

In order from the outset to link technology development and plasma physics tighly and to combine them into a major focal point, KfK and IPP in 1982 founded a joint development effort. This development effort was to be strong enough—if an NET is constructed—in order to compete successfully for this project. It would assure jobs for both German Tokamak physicists and fusion technicians for a long time in their own country. This applies to KFA scientists as well, whose research projects are to be repatriated after complete utilization of TEXTOR has ended.

Should the NET not be built in the FRG, a very large part of the scientists would have to be prepared to work in another country.

If the NET, or a similar device, should not be built for reasons having nothing to do with the scientific program—such as for financial reasons—then it would be same thing as the task of fusion research in the direction of a fusion reactor, according to the present state of knowledge. The situation would then have to be reconsidered. At the moment the participants are not counting on such an interruption, but some of them do take relocation into account. This way of looking at it in perspective is not only necessary in order successfully to pursue the experiments now under way, but also in order to be able to train properly qualified successors. According to the time frames of today, the NET could still be designed and perhaps even built by the present generation of leading scientists, but could in no way be sufficiently well operated from a scientific point of view.

3. Projects and Future of the Centers

a. IPP

This year the IPP turns 26 years old. By constructing and operating very successful experiments, it has developed into what is recognized all over the world as a top quality institute. At this time it is running two major experiments: the ASDEX Tokamak and the Wendelstein VII A stellarator. The ASDEX program is to be continued for a few years even after operation of ASDEX-Upgrade has begun. The ASDEX-Upgrade successor experiment is to begin operating in 1988, in which the plasma cleansing and plasma peripheral layer physics of Tokamaks of the NET generation are to be studied. Its scientific program will extend into the 1990's.

In the Wendelstein experiments, stellarator development will acquire a major new facility in the Wendelstein VII A, rebuilt into Wendelstein VII-AS. In the long run, the plans—assuming that the development is successful—are to build a larger stellarator, Wendelstein VII-X, with which in the 1990's the stellarator's suitability for the reactor can be determined. According to these plans, Wendelstein VII-X would be the IPP's only major facility in the late 1990's. The institute would then work with a considerably smaller group of personnel compared with today, assuming, of course, that the NET is actually coming and that the next few years of research do not yield entirely new aspects.

b. KFA

The KFA program is concentrated to use of the major experiment TEXTOR. TEXTOR is an international project within the framework of IEA. Further, there is a joint project with the Royal Belgian Military Academy, which has delivered the first major additional heating system to TEXTOR. A Dutch institute has also declared itself ready to participate in TEXTOR experiments. After full utilization of TEXTOR, the KFA program is to be transferred to the NET projects and fusion research at Juelich will be cut back. This will begin in about 6 years, according to present plans. The scientists who will be released are also to be employed by NET, to the extent possible.

c. KfK

KfK has for many years been involved in the development of large superconducting coils. This work will be continued and aimed toward the NET. In addition, the focal points of the research will include blanket and materials development, tritium cycle and remote operation. For blanket development, the construction of a new large test bay is intended in the long term. Research

equipment for working on the tritium cycle is being installed in the former SNEAK facility. The establishment of this tritium laboratory takes place with a 50-percent participation by Baden-Wuerttemberg. This will give KfK the leading laboratory worldwide for the tritium technology of the external fusion- fuel cycle, a prerequisite in the competition for a potential NET site. During the 1990's a considerable portion of the technicians and engineers will also switch over to NET.

d. University Research

In Germany studies of fusion physics in connection with the major research installations are also being undertaken by numerous universities. Among others, the Institute for Plasma Research (IPF) of Stuttgart University is delivering significant contributions to plasma heating using the electron cyclotron resonance heating (ECRH) at the Wendelstein stellarator and to plasma diagnostics with light scattering at the ASDEZ Tokamak. A close cooperation between Bayreuth University and IPP was initiated through the establishment of a research field called surface physics. Additional projects follow in the framework of the German Research Association (DFG) with the research field Diagnostics of Hot Plasmas and in the special Plasma Physics Bochum/Juelich research field, in which the universities of Duesseldorf and Essen also participate.

V. Expenditures

1. European Program

Spending for the European fusion program was established through the five-year program for 1985-1989. On the part of the commission they amount to 690 million ECU. A moved-up follow-up program, intended to cost an additional 531 million ECU, is presently the subject of discussions to be concluded in the first 6 months of 1988.

2. German Program

With the exception of about DM 2 million from the DFG, the German program will be financed by the central budgets and the respective Euratom commission. Euratom's contributions amount to 25 percent of the fusion program for a center, and for projects with priority support another 20 percent of the investment costs. The contributions vary in size from year to year and are also structurally different for the centers. Roughly figured, Euratom pays about 30 percent of the program, the Federal Ministry for Research and Technology somewhat over 60 percent and the states where they are located about 5-7 percent each.

Since the financial planning of the centers depends not only on federal and state budgets but also on the financial strength of the Euratom program, in view of the new situation in Brussels only an approximation of the spending anticipated for the German fusion program can be indicated at this time. These expenditures will run to about DM 280 million in 1988.

In international comparison, the spending figures indicated in Appendix 3 are valid for the fusion programs today.

VI. Environmental and Safety Issues

Although fusion research is still at the fundamental stage, information is wanted even now regarding safety and the effects of a later anticipated fusion reactor on the environment—partly as guidelines for safety technology requirements in the reactor design. Such data are naturally still fraught with some uncertainty, however, since they are based on extrapolated reactor studies which do not yet determine the concrete details of a future reactor.

On the basis of fundamental facts, however, the fusion reactor can be given the following favorable safety characteristics even today:

- An uncontrolled increase in power—such as during failure of the cooling system—leading to an uncontrollable power output is not possible in a fusion reactor. In contrast to a nuclear fission reactor, whose energy content in the core corresponds to roughly a year of output, the energy content stored in the fuel of a fusion reactor is sufficient only for seconds, meaning it is much too small. Furthermore, each change in operating conditions causes the fuel to extinguish immediately through plasma instability.
- The radioactive substances which also occur in a fusion reactor (tritium, activated reactor structure) have a relatively low biological hazard potential. The reactor produces no fission products or plutonium-containing materials.
- In the long run, the possibility is envisioned that the amount and longevity of the radioactive materials can be limited considerably by selecting suitable materials for the reactor structure.

With fusion reactors it is possible to expect comparatively high safety against accidents which could have serious effects on the environment: An uncontrolled increase in power is not possible; the amount of fuel in the plasma chamber is very small (sufficient for a maximum of 10 seconds of burning, and the output density of the fusion fire is about 4 Watt/cm^3).

Quantitative studies of potential disturbances and their effects are still in their beginnings, in particular because technical details for the future reactor are also still unknown. The results of such analyses, which will be continuously included in the plans for the reactor, for the moment should also serve to identify and eliminate potential reasons for disturbances. The data available today regarding disturbances can therefore only have a temporary character.

Tritium

Special safety measures are necessary, for in addition to deuterium the reactor uses radioactive tritium as fuel and the energy-rich neutrons released in the fusion of these two materials in the innermost wall and in the blanket of the reactor, which surround the combustion chamber, release secondary radioactivity. The reactor hall is therefore inadequate, and all work will be carried out by remote control.

Tritium—the heaviest and only radioactive isotope of hydrogen—has a half-life of 12.3 years. Its radioactivity (β-radiation, meaning electrons) cannot penetrate human and animal skin from outside. Danger to living things occurs only when tritium is absorbed by the body. Once in the body, tritium has an average duration (biological half-life) of 10 days.

A fusion reactor possesses an exclusively reactor-internal fuel cycle: The tritium is not produced from lithium until it is on the spot in the reactor, which is advantageous from the aspect of safety technology. In an operating fusion power plant (1 gigawatt electricity output) it is presumed that a total of 5-7 kg tritium (5-7 x 10^7 Ci) will be present, the greater part of which is bound in storage facilities, etc. The safety of fusion energy depends decisively on effective restraint of the highly volatile tritium, for example through a system of multiply safeguarded enclosures, nesting in one another. According to previous technical experience with tritium, in normal operation it appears realistic to assume a maximum tritium release by the reactor of about 2 grams per year (20,000 Ci = 74 x 10^{13} Bq).

A seriously dangerous situation would occur if tritium or evaporated radioactive structural materials were to be released in an accident. If a reactor construction is presumed which excludes the possibility that an explosion could penetrate the reactor hall, such an accident would have little effect on the outside. If nevertheless it is assumed that the safety confinement could fail, consider the case, in order to evaluate the results of tritium actually entering the environment, of about 100 grams tritium (10^6 Ci) being released. This is the proportion of unbound tritium which could plausibly excape in an accident: Pouring out at 20 m height—perhaps through a leak in the roof of the building—this would, regarded under the most unfavorable conditions, at 1 km distance result in a maximum burden of 3 to 4 rem. Released through a 100-m tall chimney, a maximum burden of 0.12 rem would result at 700 m distance. The same figures are valid for the escape of likely quantities of metal dust.

Even the very unrealistic case of a total loss of the entire tritium inventory (3-7 kg) would have consequences which lie 2 to 3 orders of magnitude below those anticipated in the event of a meltdown of a fission reactor. (It is still unclear today whether it is possible in the long run to make a deuterium-deuterium reaction technically usable instead of deuterium-tritium fusion, in which case tritium production in the reactor would be eliminated.) The probability that a case of disturbance would occur is extremely small.

Structural Materials

The structural materials activated by the fusion neutrons have half- lives between 1 and 100 years. All of them are bound in the form of solid metals (above all iron, manganese and cobalt isotopes) in the steel construction of the internal part of the reactor. The reactor produces no fission products, in particular no highly volatile or gaseous radioactive fussion products. Thus, before the activated structure in normal operation practically no radioactivity (a few Curies per year through corrosion products) is released to the environment.

During the 30-year life of the plant it is today believed that the first wall and the blanket will have to be replaced about four times due to the great stress.

Hence, during its entire life a fusion reactor produces an estimated 4,000 m^3 medium-radioactive waste and 2,000 m^3 highly radioactive metallic waste. Quantitatively, this corresponds to about twice the waste occurring in a fission reactor, but qualitatively there are major differences:

Thus, the biological danger potential through fusion is about 2 orders of magnitude, and after 100 years already a factor of 2000, lower. The half-life values for fusion residue are significantly lower—1 to 100 years as against 100 to 10,000 years in the case of nuclear fission. These advantages can even be increased considerably if instead of the conventional steel types now considered for the first wall and the blanket modified steels are used. Steels without contaminating additions such as nickel and molybdenum (the economic production of which are considered realistic after some development work), would make long-term isolation of the waste for more than 40 years superfluous. Radioactive waste would then only accrue in the consumer generation which produced it. Over longer periods of time there would, because of the shorter half-lives, be no accumulation of radioactive materials, which in part would even be reusable.

No safety problems are anticipated from the effects of large magnetic fields and the high-frequency radiation. The burden on the environment comes from the disposal of radioactive structural material from the fusion reactor and from the potential release of tritium.

VII. Economic Utilization of Nuclear Fusion

Economic utilization of nuclear fusion for the production of energy, which will become possible in the middle of the next century at the earliest, appears attractive primarily because of the highly secure supply of fuels: The raw materials necessary for nuclear fusion—deuterium and lithium—can be extracted with conventional

technologies, are present in nearly unlimited quantities, are evenly distributed throughout the world and can release large amounts of energy. Through nuclear fusion one gram of deuterium and lithium—from which the actual fusion partner of the deuterium, the tritium, is produced in the reactor—can produce 24,000 kWh_{th}, that is about 8,000 kWh_{el}. This is the equivalent combustion heat of 3 tons of coal. With a supply of 1 ton natural lithium and 120 kg deuterium, a fusion power plant with 1,000 megawatt net electric output could work for 1 year at peak capacity.

Cost predictions for this source of energy are very uncertain at the present stage of research, since the future conditions for production and operation are unknown.

For the moment, the existing experiments are aimed at the physical- technological goal and not at minimizing costs for the ultimate commercial end product. Since those physical and technical parameters which mainly influence the costs of a fusion reactor have already been identified, however, it is now considered possible to give estimated figures on the order of a magnitude for the actually occurring costs. It is anticipated at present that the power production costs of a fusion reactor will be only slightly higher than those of a light-water reactor.

Comparisons of the power production costs of various energy sources with each other are only of limited reliability, however, since even evaluations of the alternatives available in about 50-70 years (nuclear fission, coal and solar energy [photovoltaic]) present major uncertainties and the estimated cost intervals overlap in broad areas.

11949

France in Race To Develop Laser Uranium Enrichment

36980389 Paris L'USINE NOUVELLE in French 30 Jun 88 pp 36-37

[Article by Odile Esposito and Elisabeth Rochard: "Laser Race for Uranium Enrichment"]

[Text] A new laser enrichment technology is emerging to compete against conventional gas diffusion. Its advantages are energy conservation, simple implementation, and space savings. The Americans have gained the lead, but the AEC is holding on.

From the heavy-water battle, through the war of technologies, nuclear history has always depended on the military. Today, the confrontation is taking place in the area of enrichment; a mighty battle, pitting America's huge Department of Energy, known as DOE, against the French Atomic Energy Commission and its subsidiary, Cogema. The stakes are sizable: the world's enriched uranium market. It represents 26 million UTS (separative work units) needed to operate the 200 nuclear gigawatts installed in developed countries, not to mention the approximately 40 plants to be started by the year 2000. That represents a market of $3 billion per year, which will be kept by the one who wins the laser race.

Among other drawbacks, gas diffusion techniques currently used both in the United States by DOE and in France by Eurodif, have the shortcoming of being very "energyvorous." Lasers are much more economical, since the energy needed is used to excite only the fraction of interest, uranium 235 (namely 0.7 percent of natural uranium). Another advantage is that lasers work with uranium metal, thus eliminating the elaborate transformation into hexafluoride. The research conducted by the two countries, whether by Silva for AEC or Avlis for DOE, is based on the same techniques.

Solid uranium is placed directly into a cold crucible and bombarded with an electron beam; its temperature then increases significantly to more than 2000 °C, and the uranium is vaporized. The vapor is carried into the beam of a dye laser, whose frequency is adjusted with extreme precision so that only uranium 235 (the smaller fraction) is excited and picked up on collector plates. These lasers are boosted by much more powerful (about 100 watts), fast (5 kHz), pulsed copper-vapor lasers. In France, these are manufactured by Cilas under AEC license; Laurent Citti, the company's CEO and head of CGE's Marcoussis laboratories, expects to develop them.

For small amounts of uranium and for relatively low laser powers, AEC's research is yielding satisfactory results. Unfortunately, greater quantities cause multiple collisions and significant charge exchanges; the charges move equally toward uranium 238 atoms, transforming them into ions, as toward uranium 235 ions, transforming them into atoms. The effect is then contrary to the one being sought, in that uranium 238 ends up being gathered on the collection plates!

The lasers also worsen with greater power; interactions occur between the uranium vapor and the radiation, which then tends to become distorted. The compactness of the installations, which does have economic advantages, also compels very strict equipment management. Will the lasers withstand several hundred or thousand hours of operation? Will electric power supplies, operating at several kHz, last long enough? All of them technological difficulties which remain to be surmounted.

Having started the first, in 1973, the Americans now have the lead; along the way, they did not hesitate to abandon their research on the ultracentrifuge process (total loss of an investment of several billion dollars, and teams of researchers unemployed overnight) to concentrate their efforts on the Avlis project.

The American's lead of four or five years is not challenged by AEC. "The Americans move more readily into the preindustrial stage, while we tend to push laboratory research," explains Andre Schneider-Maunoury, director of Cogema's enrichment branch.

Different approach or not, the Americans did not stint on resources. To the $90 million (Fr500 million) allocated by DOE this year, are added the Department of Defense funds which practically double the sum. With its budget of Fr250 million, Silva almost looks like a poor relative!

"The Americans are dreaming of rebuilding the monopoly which they held for so long, and which has been challenged by Eurodif," says Francois de Wissocq, Cogema's CEO. A situation in which the electric power companies have no wish to find themselves, and for good reason, since DOE's attitude during the 1970's has left its scars. The only producer of enriched uranium at a time when the fear of energy shortages had given rise to the craziest nuclear programs, DOE was the law on the market, selling when and at whatever price it wanted. As a result, its prices increased by 25 percent in six months.

"In 1973, we signed supply contracts with Japan at a price twice as high as DOE's, and at a time when the foundations of the plant were not even laid down, for the single reason that our prices were firm and final," recalls Jean-Pierre Rougeau, director of sales at Cogema. Since then, the AEC's subsidiary controls slightly more than one-third of the enriched uranium market. It has even gained a toehold across the Atlantic, primarily due to the weakness of the dollar. Could it be the Cogema example? Whatever the reason, the DOE's enrichment activities will be transformed, like Cogema, into a nationalized-capital company, the US Enrichment Corporation. The manufacturers that were invited preferred to steer clear of an enterprise which does run some risks and which is saddled with a $13 million debt, even if the bulk of this debt is to be absorbed in profits and losses.

The game is far from over. Current enrichment capabilities are 30 percent greater than needed, and will remain that way for at least ten more years. "A new industry develops either because it is pulled by the market, or pushed by technology," points out Mr Rougeau. The first reason is certainly not valid, which leaves the second one. "If it turns out that Silva produces UTS twice as inexpensively, the investment will be justified," states Mr Schneider-Maunoury. Another meaningful argument encourages Cogema to favor Silva: the laser technique makes it possible to separate without any problem the uranium reprocessed at The Hague, which proves to be a true poison for gas diffusion. "Silva would make it possible to minimize the penalties associated with uranium recycling," explains Mr Rougeau.

On the fringes of this confrontation between France and the United States, the Japanese could be, if not the outsiders at least the spoil-sports. Having placed their bets on ultracentrifuging, and without dropping their research in that field, they have increased their laser budget from $5 to $65 million thanks to the support of such companies as Mitsubishi, Hitachi, and Toshiba. Their stated objective is to cover 30 to 50 percent of their needs in the year 2000. And while they're at it, they could stretch to the neighboring markets (Korea, China, Taiwan), which worries both AEC and DOE.

11023

SCIENCE & TECHNOLOGY POLICY

EC Vice President on European Technology, Competition

3698M472 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 480, 27 May 88 p 11

[Article by Dr Karl-Heinz Narjes, Vice President of the EC Commission [EC Vice President's Comments Excerpted by Source]: "TN Commentary: Internal Market and Technological Community]

[Text] The route leading to an internal market is clear, the spectrum of problems to be solved extensive. It extends from the removal of all vestiges of internal EC border checks to the liberalization of the service and capital goods markets to the difficult task of coordinating control. Some things have already been achieved and important matters have been initiated. Much remains to be done. Time is short.

The commission wants to push forward more than 90 percent of all the suggested individual measures by the end of this year. The Single European Act, which went into effect last year, provides for greater likelihood of a majority vote within the Council of Ministers and the transfer of more performance responsibility to the commission; these two innovations will speed up the decision-making process.

The establishment of the internal market is taking place against the background of a persistent period of change within the international economic arena. The United States and Japan think that they can divide up the international high technology markets between themselves with impunity at the expense of the European Community. We will not just stand by and watch. Removal of the physical, technical and fiscal barriers, as the internal market dictates, is not sufficient all by itself for enabling Europe to stay in the race in terms of technological potential.

A structural assurance of competitiveness presupposes specifically that the expertise needed for top technological performance and the required quality and quantity of human labor resources will be available when needed and will be used more efficiently at the European level. In the past, competitive weaknesses in European industry were due to too great a fixation on national internal markets which were too small and to dispersal of national R&D locations as a result of a lack of cooperation across national boundaries.

Technology, high technology in particular, knows no boundaries. In high technologies such as microelectronics, computer engineering and telecommunications, "critical masses" are required which are often beyond the capabilities of the largest European companies and the smaller national economies. In this situation the Commission has developed the concept of a European technological community which can help provide a solution. By adding a new "technical R&D" chapter to the Single European Act, the obligation to increase European cooperation in the technological area has been written into law.

Internal market and technological community are there fore important complementary building blocks for the continuing development of European unity. This is particularly clear in the opening up of public markets largely intended for high technology products and in the development of standards requiring joint efforts in R&D.

With the multi-year master plan for technological research and development the EC has been given an instrument for translating the technological community into a coherent plan of action over the medium-term; the initial master plan provides for community funds amounting to more than DM 13 billion from 1987 to 1991.

Implementation of the master plan extends from projects in the areas of health and environment to the creation of a Europe for researchers. The focal point is clearly the promotion of industrial competitiveness with a particular emphasis on information and telecommunications technologies. The first community programs in this area are ESPRIT, RAC,E and the industry-oriented BRITE program.

The enormous enthusiasm of the engineers and scientists from industry, research facilities and universities and colleges which went into preparing the suggestions is evidence of the growing awareness regarding Europe's future challenges and above all regarding the joint internal market. The willingness to cooperate of those who submitted proposals underscores Europe's position in the high technology sector of the international market. The commission therefore deeply regrets that its funds are not adequate to support all of the good projects proposed. The overwhelming reaction to our request for proposals is clear evidence of the necessity of a joint European initiative in support of research and development.

Research and development in the most important new technology sectors in Europe are conclusively dependent on the initiatives of the European Community. European decision makers will increasingly have to take this fact into account.

12552

Joint ONERA-CNRS Microstructure R&D

36980353d Paris ELECTRONIQUE ACTUALITES in French 17 Jun 88 p 14

[Unsigned article: "Joint CNRS-ONERA Research Unit on Microstructures"]

[Text] The National Center for Scientific Research (CNRS) and the National Office for Aerospace Research (ONERA) have announced the creation of a joint research unit named the Microstructural Study Laboratory. The objective of the two partners is to "bolster their research in high performance structural materials by benefiting from their respective abilities and potential." The laboratory will be located at ONERA's Chatillon site (near Paris), under the leadership of Patrick Veyssiere, master lecturer at the University of Poitiers, assigned to CNRS.

The group's task will be to carry out fundamental studies that would identify through microscopic observations, the mechanisms that govern the plastic properties of metallic materials (dislocation motion, precipitation phenomena at the 10-100 nm scale, with local analysis of precipitates). For this purpose, it plans to buy a medium voltage (400 KV) electron transmission microscope equipped to perform chemical analysis with X-rays and through electron energy loss.

11023

COSINE: Europe Wide Research Data Communication Network

36980390a Rijswijk PT/AKTUEEL in Dutch 6 Jul 88 p 6

[Text] It will be possible to accelerate the EUREKA project COSINE. The COSINE Policy Group, the policy-making group for the project, met at the end of June in Egham (Great Britain) and made several decisions that will contribute to that acceleration.

On the basis of these decisions, negotiations will be opened with the European PTT's to create the links necessary to form the basis for the future COSINE infrastructure. The purpose of COSINE (Cooperation for Open Systems Interconnection) is to develop an integrated infrastructure for data communications among researchers at Europe's universities, research institutes, and business laboratories. All the countries of Western Europe, the European Commission, and Yugoslavia are participating in the COSINE project, which has now reached an important stage: July will mark the end of the specifications stage. In this phase of the project, the technical work has been carried out by RARE (Associated Networks for European Research), the European association of research networks and users. The 3-year implementation phase is scheduled to start in January 1989.

Backbone

At the above-mentioned meeting a joint statement by RARE, EARN, and EUNET (the two most important existing computer networks for researchers) was met with enthusiasm by representatives of the participating countries. In this statement the parties indicated that they will coordinate with one another on the basis of the results of the COSINE specifications phase to work on making the transition from current services, which are not based on official standards, to a single data communications infrastructure based on the so-called OSI model (Open Systems Interconnection).

As a result of this statement of principles, a working group has been set up with representatives from RARE, EARN, EUNET, HEPNET (computers for high energy physics), SPAN (astronomy computer network), and IES (the communications system for the EC research programs). This working group is studying how to provide basic communications for the COSINE infrastructure in the form of a Europe-wide telecommunications protocol "X.25-backbone."

At the Egham meeting, the working group presented its first interim report. Based on this, the COSINE Policy Group authorized the working group to negotiate with the European PTT's on supplying that backbone. The Netherlands PTT has offered to take the lead here on the basis of the "managed data network services" concept. The EC and the Norwegian government have already earmarked some 2.5 million guilders to work this out and for the first operational phase.

COSINE Management Unit

The COSINE Policy Group also established the guidelines for organizing the implementation phase. A large number of the activities in the 1989-1991 period will take place at the national level. A COSINE Management Unit will be set up for developmental activities at the European level. The Policy Group set up a task force to work out a plan for the implementation phase by 1 October in the form of a business plan.

The international activities during the implementation phase will cost about 125 million guilders. Total developmental work at the national and local level in the participating countries will certainly cost 1 billion guilders.

Earlier this month the EUREKA ministers conference in Copenhagen confirmed its support for proceeding with the COSINE project. The EUREKA ministers undertook to provide the necessary financing in their own countries. In its next two meetings (October and December), the COSINE Policy Group will make the final decisions as to the content, organization, and financing of the COSINE implementation phase.

12593

EUREKA Participation Called a 'Must' by Austrian Officials

36980374 Vienna DIE PRESSE in German 22 Jul 88 Supplement p 1

[Article by Hedi Cech: "Springboard Into High-Tech Europe: Increasing Numbers of Domestic Companies Participating in the EUREKA Research Initiative"]

[Text] For Science and Research Minister Hans Tuppy the EUREKA presidency is a research policy must; he is calling for a 2-billion-schilling budget increase to be able to reach the coalition goal of spending at least 1.5 percent of the GNP for science and research in 1990. The 1-year presidency should accelerate political and business awareness of Austria's membership in a Pan-European planned technological community.

For the domestic economy, Austria's presidency represents an opportunity. Although industry reacted very cautiously in 1985 when the EUREKA research initiative of 19 EC and EFTA countries was launched as a response to the U.S. Strategic Defense Initiative (SDI), the situation has changed considerably since then. Of the total of 214 projects (total volume of approximately 70 billion schillings), 21 involve Austrian participation. In this effort, the companies themselves provide three-fourths of the contract volume of 450 million schillings; the remainder comes from various federal research funds. The major emphases are on laser technology, biotechnology, advanced materials, communications technology, robotics, and environmental technology.

Large companies have long recognized the advantages of the EUREKA system—in contrast to other EC programs such as BRITE and ESPRIT, even ideas for projects may be submitted—and are using the research initiative as a springboard for international cooperation. However, small and medium-sized firms are still cautious. Franz Marhold of the Ministry of Science cites a pent-up demand: "There is no lack of interest and ideas, but rather a lack of financial and personnel resources and expertise for implementation."

Precisely because "EUREKA projects with their market-oriented design offer domestic firms the opportunity to cooperate as equals in leading edge technologies" (Marhold), a joint public relations campaign about EUREKA is about to be launched with the Ministry of Foreign Affairs. "We want to motivate small and medium-sized firm through various events," reports attache Hans Brunmayer, responsible for coordination in the Ministry of Foreign Affairs.

An important component of the promotional campaign is the improvement of the infrastructure, which means increasing the funding of technology. "In addition to that, we want to work with credit institutions and with industry to develop and offer models for venture capital

financing," reports Brunmayer. "This also includes risk insurance, which could certainly alleviate many of the worries of small companies."

Hans Loeschner does not try to disguise the facts. "There are plenty of problems—regardless of whether we are talking about money or personnel or technical equipment." Yet, for the managing director of IMS Ion Microproduction Systems GmbH of Vienna, the positive aspects predominate for the 37-man company which has made an international name for itself by developing a machine for ion projection lithography. This process, which presents significant advantages in chip manufacture, must now be prepared for the market. Loeschner is able to appreciate the potential of international cooperation, "We have specialized, but the domestic market is much too small for us."

According to Hubert Bildstein, managing director of the Metallwerke Plansee GmbH, it is precisely this specialization that makes it possible to excel internationally. The Tirolese high-tech firm has experience—it was part of EUREKA from the beginning. As a matter of fact, superconducting wires and coils for high-tech applications are currently being developed with seven partners.

Bildstein is convinced that size alone is not the decisive factor for successful EUREKA participation. "There is often a lack of European thinking and action, in attitude, and only secondarily in ideas." In international projects it is also possible to expand a good reputation. In his opinion, "If we are already the leader in a sector, why shouldn't we demonstrate that?"

Guenther Lieberzeit is also convinced that it is often the fault of the firms themselves if they are left out of the international technological community. "They are often not accustomed to thinking in such dimensions," claims the technologist who is in charge of international contacts for Schrack. The electronics firm has been able to do that for a long time. At first, the cooperation in FAMOS [Flexible Automated Assembly Systems] consisted primarily of developing appropriate designs on the "drawing board," whereas now it is a matter of actual application of flexible automation in production and assembly of relays in the Waidhofen and Kindberg plants. So far Schrack has invested approximately 120 million schillings in this project.

The OASIS project seemed virtually tailor-made for involvement of a group of specialists at Voest. "In 1986 we already had in place a system developed in house which increases the security of EDP systems in international data transmission and connection, in user identification and access control," reports Ingrid Schaumueller-Bichl. She continues that in this sector reasonable solutions can only be achieved through cooperation and that it would therefore be inconceivable for the Voest team not to participate in such projects.

Although the private initiative of a small Voest team introduced the steel giant to EUREKA quite early, the biotechnologists of Chemie-Holding have just recently taken the plunge into high-tech competition. Participation in the Euroseed project (production of fungus resistant seed for sugar beets, corn, soy beans, and sunflowers using microbial seed treatment) means for Hans Kroath, first of all, the possibility of using the knowledge of foreign seed producers. "Furthermore, it brings prestige and improves our image."

The increase in the level of recognition is only secondary for Immuno AG. "Unquestionably of even greater importance is the increased problem solving capability," stresses Johann Eibl. "Of course, one no longer has exclusive right to the results." However, the advantages more than make up for this disadvantage. After all, the pharmaceutical firm has invested 160 million schillings in cooperation in EUREKA project No 104. That number represents the development of technologies for production of cell cultures on industrial scale. In turn, products for diagnostic, prophylactic, and therapeutic purposes are to be acquired from them.

After two years of involvement with EUREKA, Eibl warns, however, against excessive euphoria: "Participation is only reasonable in those cases where we also make the transition to production in Austria and make economic use of it." However, Schrack's Lieberzeit is not so reserved: "Whether domestic industry participates in high-tech programs or not—that ultimately determines its existence or nonexistence."

12666

German Research Association 1987 Report Submitted

36980367 Duesseldorf HANDELSBLATT in German 24/25 Jun 88 p 22

[Article: "A Sharp Increase in Funds Is Necessary in the Next Few Years"; first paragraph is HANDELSBLATT introduction]

[Text] Duesseldorf, 23 Jun (HANDELSBLATT)—The German Research Association (DFG) in Bonn is lamenting the fact that its funds will be far from adequate to permit appropriate support of scientific programs. The "1987 Progress Report" has just been presented.

The DFG serves all branches of science through financial support of research projects. In numerous fields of knowledge, it has increasingly assumed the tasks of reinforcing cooperation among researchers and coordinating basic research and harmonizing it with public support of research. It focuses special attention on the support of the next generation of scientists.

Prof Dr Hubert Markl, president of the DFG, states that an acceptance rate of approximately 60 percent for projects submitted would be "appropriate and desirable." In 1987, the acceptance rate for grants approved through normal procedures fell below 50 percent for the first time in the 1980's. There is, of course, no natural guideline for an ideal acceptance rate; however, the danger arises that because of the current pressure in the selection process, the "relevance" argument, i.e., immediate consideration of the practical consequences of the respective project, can assume inordinate significance.

According to Markl, "There is no longer any room for innovative projects whose usefulness is not obvious at the first glance; in fact, whole areas risk falling through such a coarse screen. This no longer permits compliance with the DFG's charter to encourage science in all its branches (certainly not to inhibit it!)." It is also necessary to take into consideration the fact that there are a fair number of areas, primarily in the humanities, for which the normal procedures of the DFG are the only source of financing for subsidized research.

In this connection, the DFG president points to the international experience: "For the Swiss National Fund for Promotion of Scientific Research, which is quite comparable to the DFG in the structure of its activities, an acceptance rate of between 60 and 67 percent is the norm."

In 1987, the DFG senate was able to recommend to institutes only 11 new programs in the major areas of emphasis, whereas 13 other proposals had to be rejected or postponed.

In 1987, DM1,087.0 million was available to the DFG, including DM644.6 million from the federal government, DM420.5 million from the Laender, DM4.8 million from foundations, and DM2.8 million from its own revenues plus budget funds caried forward in the amount of DM14.3 million. More than 90 percent of DFG research funds go to the universities. The payments break down by individual categories as follows: general support of research, 64.3 percent; special areas of research, 29.9 percent; Heisenberg Project, 1.2 percent; Leipniz Project, 1.2 percent; administrative expenses, 3.4 percent.

Last year the DFG awarded a total of DM1,030.6 million in the four areas of science. Of that, 14.0 percent went to the humanities and social sciences; 35.4 percent to biology and medicine, 28.0 percent to the natural sciences, and 22.6 percent to the engineering sciences. The respective figures for 1985 were 14.5 percent, 37.9 percent, 24.1 percent, and 23.5 percent.

The individual fields received greatly varied support. The 1987 breakdown among the leaders was as follows: medicine, nutritional research, DM166.3 million; biology, DM156.0 million; general and mechanical engineering, DM150.4 million; earth sciences, DM112.1 million; physics, DM94.4 million; chemistry, DM69.7 million; social sciences, DM54.7 million; electronics, data processing, DM42.9 million; history and aesthetics, DM36.8 million.

In 1974, the DFG spent DM610 million on research; in 1986 the figure had climbed to DM1,029 million. This apparent clear increase in spending by 68 percent in 12 years is put into perspective when the rate of price increases for public expenditures is taken into account: Then, a real increase of barely 7 percent remains, according to the progress report. The DFG's share of the research outlays of the universities declined between 1975 and 1985 from 13.6 percent to 12.7 percent; its share in the outside funding of universities has dropped from 48 percent to 40 percent since 1980. According to the report, more funds will be necessary for support of research in the future. As Markl says: "Because the only sensible thing to do is to continue to encourage the young people now in their most creative period, rather than trying to attract them back into research sometime in the future, once they have been driven out for economic reasons."

12666

Sweden Moves Toward More Participation in EEC

Industry Leader Recommends Participation

36980385 Stockholm NY TEKNIK in Swedish 7 Jul 88 p 5

[Article by Harry Amster: "Sweden Must Participate in EEC Research"; first two paragraphs are NY TEKNIK introduction]

[Text] Small and medium-sized firms must reconsider and start participating in EEC research. Otherwise Sweden risks ending up on the international side lines.

That is the opinion of Jan Freese, executive vice president of the Federation of Swedish Industries.

Only a few big Swedish companies participate in EEC's research program.

A spokesman for the Association for Metal Transforming, Mechanical and Electromechanical Engineering Industries thinks this is due to ignorance. Many people do not know the program exists. And in addition, people are unaware that Swedish companies are eligible to participate.

It is also a question of money. Swedish firms have to pay for everything themselves while EEC companies have half their budget paid for by the EEC Commission.

"It is very trendy and 'in' to talk about EEC but only on a policy level. When it comes to practical matters people know very little," said Eva Hellhoff, who handles EEC matters for the association.

Need R&D

Jan Freese is a member of the panel that is evaluating the EEC project known as BRITE (Basic Research in Industrial Technologies for Europe).

He says many small and medium-sized companies are unaccustomed to pursuing research and development:

"Enterprises of this size need R&D too. But of course it is a switch to look for cooperating partners down in Europe. Small industries need to reconsider."

Does he think there is a risk that Swedish firms will lose touch with competitors if they fail to participate in EEC research?

"Yes, we risk both an increased brain drain and the prospect of ending up on the international side lines," said Jan Freese.

Ericsson is one of the few Swedish firms participating in an EEC research project.

Competitiveness

The project in question is RACE, which stands for Research and Development in Advanced Communication Technology for Europe. The goal is to develop telecommunications technology to increase the competitiveness of the EEC countries.

"In general I think it is extremely important for Swedish industries to participate in EEC's R&D projects. In our case it is even more important because RACE is based on producing the next generation of telecommunications systems," said Hans Giertz, chief of systems and technology development at Ericsson Telecom.

He thinks Swedish companies take EEC research too lightly:

"One cannot join in without making an effort."

We asked if his company was taking part in order not to fall behind.

"Yes. EEC pursues a telecommunications policy that will change competitive conditions in Europe. So it is important for us to maintain visibility, participate and exert some influence."

Jeopardized

Is he taking part for competitive reasons, in other words?

"Definitely," said Hans Giertz.

He thinks there is a risk that other international research projects will be jeopardized because EEC companies get so much financial support. This could adversely affect Sweden which would end up outside EEC circles:

"If we look at the new policy in England, Maggie Thatcher has cut down on national programs because she feels European projects cover research just as well.

"Ignorance about EEC research must be eliminated in Sweden. Swedish industries need to be shaken up a little," said Hans Giertz.

Government Allocates Funds

36980385 Stockholm NY TEKNIK in Swedish 14 Jul 88 p 4

[Article by Harry Amster: "STU Investing in EEC"; first paragraph is NY TEKNIK introduction]

[Text] The National Board for Technical Development [STU] is now providing 20 million kronor for Swedish companies that want to conduct research within EEC. And more money is promised for next year.

In last week's issue of NY TEKNIK, Jan Freese, executive vice president of the Federation of Swedish Industries, urged Swedish companies to start participating in EEC research. Otherwise Sweden runs the risk of ending up on the international side lines.

Birgit Erngren, director general of the Board for Technical Development [STU] agrees:

"I think it is extremely important for Sweden to try to participate in EEC's research program. And we must gradually set aside more and more money for this purpose," said Birgit Erngren.

One Percent

STU feels Swedish firms should be able to conduct research on the same terms as EEC companies, which have half their budgets paid for by EEC.

"We have allocated about 20 million kronor for this purpose. That may not be very much, for we probably need 200 million kronor. But if we get started right away and produce the funds little by little, we can see how big the demand is," said Birgit Erngren.

Why is it so important for Swedish firms to participate in European cooperation?

"Sweden accounts for 1 percent of the world's research and development. We are a very small country and need international cooperation," Birgit Erngren said, adding that Sweden has a lot of bilateral cooperation with European countries:

"But I think there will be less of this type of cooperation in the future. As the EEC programs become stronger, the EEC lands will give them top priority and then we cannot be sure that they will have the energy, the funds or the opportunity to cooperate with little Sweden."

More Money

We asked if the agency was planning to devote more money to EEC research.

"Absolutely. That is a necessity," said Birgit Erngren.

How does the government feel about putting money into research and development within EEC?

Folke Schippel, who is an Industrial Affairs Ministry section chief, said this:

"With regard to financing, of course, we will have to wait and see the total stand the government takes on the various issues when it is ready and can see how to solve the problems that are well-known even here."

But will Swedish companies participate on equal terms with EEC companies?

"I cannot comment on that at this time," said Folke Schippel.

06578

SUPERCONDUCTIVITY

Netherlands Government Sponsors Ceramic Superconductor Research

3698A295 Zoetermeer SCIENCE POLICY IN THE NETHERLANDS in English Jun-Jul 88 p 18

[Article: "Go Ahead for Grants to National Research Programme Into Ceramic Superconductors"]

[Text] Dr R. W. de Korte, the Minister for Economic Affairs, has allocated eight million guilders for a national research programme into ceramic superconductors, to cover the period 1988-1989. The Minister of Education and Science, Mr W. J. Deetman, will announce his ministry's contribution to the programme shortly.

The programme was jointly drawn up by universities, research institutes, and the private sector, who also put in a joint application for 16 million guilders in government funds.

The project proposals will be assessed by a steering committee which will be set up later. Conditions will also be drawn up on the distribution of work and the concentration of research. The government's contribution is intended to boost research in ceramic superconductors in the Netherlands.

New Dutch Laboratory for Superconducting Thin Films

36980390b Rijswijk PT/AKTUEEL in Dutch 6 Jul 88 p 6

[Text] Last week the Low Temperatures Group at Twente University took possession of its second new laboratory this year. This time it was a laboratory for producing thin films of superconducting materials, new (ceramic) superconducting materials as well as "classic" superconductors. The money and staff necessary for the creation of this costly laboratory came from the university itself, from business, and from scientific institutions such as FOM [Foundation for Basic Research on Matter] and Psychon. The new laboratory will be used for producing Squids, among other things. These are superconducting magnetic instruments for detecting very weak magnetic fields. Among other things, they are used for equipment to measure brain activity and in the area of materials research. Another major interest will be new high-temperature superconductors. Superconducting electronics will probably be the first applications area for these new materials.

12593

TECHNOLOGY TRANSFER

Austrian Company Accused of Illegal Computer Sale to Hungary

36980373 Vienna KURIER in German 15 Jul 88 p 13

[Text] The Ministry of Commerce, judicial and security officials are currently tracing a technology transfer.

A Lower Austrian entrepreneur had sold to Hungary a computer system, the sale of which to the East is forbidden. Was it an action in the service of news reporting, a "favor" or merely inattentiveness? The KURIER has followed the very tortuous road of the apparatus to its new receiving site. In October 1985, the FRG citizen, Hermann Steinhoff, applied at the Ministry of Commerce for an import permit for the "Multi-user-computer-network system CADMUS with distributed intelligence, based on the MC68000-processor and the MUNIK-operating system." The computer setup costing DM 535,295 was to be set up in the Steinhoff office in Brunn/Gebirge.

A few months later, vital parts of the setup were already in the "Gagarin" Coal Processing Plant in Heves megye, east of Budapest, and in the "Express" travel office, in Budapest. In the course of a control visit by a representative of the Ministry of Commerce to the Steinhoff Company in December 1987, in Brunn, the scandal erupted and suddenly there was fire and brimstone.

However, Steinhoff belongs among the large technology intermediaries between East and West. He arranges, for a commission, the transfer of industrial equipment,

construction machines and similar products from Western firms to the CSSR, Hungary, Yugoslavia, Bulgaria and Romania. His sales are around 500 million Schillings per year.

Steinhoff denies having devised an illegal transfer mechanism. He himself feels deceived. The hardware and software merchant in Budapest, Istvan Major, had recommended the CADMUS-9230 to Steinhoff for Brunn. When, after a short time, a co-worker of Steinhoff came to the decision, now questioned, that the system is useless, Major appeared on the scene as a rescuer in need. He allegedly had two Hungarian customers who would buy parts of the system. Thereby the loss would be limited.

The crates with the parts crossed the border at Klingenbach—under a false declaration, according to the opinion of the Ministry of Commerce. Fully and correctly declared, was the opinion of the Steinhoff people. They simply wrote "computer" on the customs declaration, that was enough for the customs officials. The Ministry of Finance will examine the case.

The euphoria of the Hungarian end-receiver over the supertechnology from the West is being kept within limits. In the "Gagarin" Heat-Energy Plant, with 1,800 employees, the service and inventory records are more rationally set up according to EDV, a system of the British energy consultant, "Maynard and Berry, Ltd." The old Soviet computer, "MS4" is not sufficiently efficient. It was reinforced through the CADMUS unit. Allegedly, for two years, the Hungarian technicians had their hands full coupling the two systems. It is now working—with problems. There are no spare parts available.

In addition, the CADMUS is compatible with hardly any of the EDV-setups of other Hungarian enterprises. They all are equipped with partly more efficient systems of an American computer network. And that is bought completely legally—at the general representative of the network right in Budapest, although at a horrendous price.

The Hungarians speak of an economic war. While it is forbidden for Europeans to sell any "better pocket calculator," the Americans make enormous deals with high-tech machines.

The employees of the Express Travel Bureau were altogether overstretched. There, the computer stands in a fully air conditioned broom closet, is plugged in every day, but no one can handle it. Express wants now to sell its computer as a living storage of parts to "Gagarin..."

Under the number 27D St 17342/88, the state attorney of Vienna is now set to untangle the CADMUS story and the Lower Austrian criminal department is bringing charges. There is further irony involved: in the meantime the outdated CADMUS has lost the detrimental certification as "HighTech"—since January—and Steinhoff can now legally export to Hungary its third computer still in Brunn, perhaps as a source of replacement parts.

2473

COMPUTERS

Czech Microcomputer Used in Metallurgical Thermal Analyses

Leipzig GIESSEREITECHNIK in German
No 5, 1988, pp 156-158

[Article by Dipl. Eng. M. Lubojacky, Dipl. Eng. P. Hradecky, Dipl. Eng. A. Madryova and Dipl. Eng. M. Krenek, College for Mines and Foundries, Chair of Casting Technology, CSSR; Lecture given on the occasion of BHT 1987 in Freiburg: "Use of TNS Micro-Computer To Evaluate Thermal Analyses for Sub-Eutectic Cast Iron Melts"]

[Text]

1. Introduction

At the present stage of science and technology (S&T) progress, microelectronics is increasingly being used in all areas of the economy, both in the production process and in S&T work. This is connected with changes in quality and technology.

One possibility of using microelectronics consists of verification tasks such as exist in metallurgy. The development of these new, progressive verification and diagnostic systems has previously been given little attention. The import of these devices is limited, and in the socialist countries these special devices are produced only to a limited extent. The objective of the present work therefore is to indicate some possibilities for the qualitative use of the accessible measurement technique for these purposes. The case treated here involves direct evaluation of measured dependencies by means of an office computer TNS by using thermal analysis.

2. Measurement Methodology

To sense and record cooling curves, one uses the measurement units CE 531 and DMT 1550. Both are produced by the State Research Institute for Materials (SVUM, Brno). The measurement unit CE 531 is used in many foundries to determine the carbon equivalence CEL by means of thermal analysis (TA). It is equipped with a calibration unit which makes it possible to use bias voltages to suppress temperature regions and to compensate the thermo-electric voltage of the NiCr-Ni-, PrRh10-Pt-, and PtRh30-Pt-thermocouples. To evaluate these measurement results by means of a TNS micro-computer, one uses the analog-digital ADC-8 converter (manufacturer: Agrokombinat Slusovice).

The disadvantage of this measuring method consists in the necessity of having to use this eight-bit converter for the measurement data, which unfavorably influences the measurement accuracy. Nevertheless, this solution is more favorable than having to evaluate all the data on a manual unit, as is customary with conventional TA measurement.

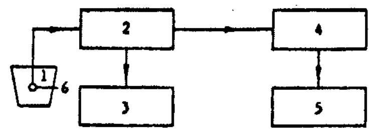


Figure 1. Structure of the Measurement System

Key:—1. Specimen body—2. Measuring unit type CE 531 or DMT 1550—3. Recorder TS 4100—4. Micro-computer TNS—5. Printer—6. NiCr-Ni thermocouple

The digital thermal measuring unit DMT 1550 can be used successfully for transmitting data precisely to the micro-computer system, and for recording the thermal voltage. This unit has a 12-bit analog-digital converter, which makes it possible to connect the measuring unit to the micro-computer through the binary inputs and outputs BIO. The cast iron specimen is cast in standardized mask forms for the TA measurement. The temperature in the cooling specimen is sensed by an NiCr-Ni thermocouple. This is affixed in the thermal axis of the sample, without a protective tube. As a result, an adequate measurement reproducibility is achieved.

The value of the thermoelectric voltage is recorded continuously by means of a recorder TZ 4100 or TZ 4200 (manufacturer: Laboratory Units, Praha).

The measurement and evaluation technique used is shown schematically in Figure 1.

3. Evaluation of the Measurement Result

3.1 Description of the TNS Micro-Computer

The micro-computer TNS is a universal system which works with the R-BASIC language. It is manufactured in the Agrokombinat Slusovice. This involves a micro-computer system in modular form. It can be used not only to gather process data, but also for S&T calculations and for the guidance of technological processes in real time operation. Due to its modular construction, peripherals such as a printer, diskettes, memory, receiver and punch for paper tape, magnetic tape memories, or language translators can be connected. By means of the peripherals—ADC and DAC converters, binary inputs and outputs, programmable inputs and outputs, asynchronous parallel and series transmission—data sets and dimensional quantities from real processes can be gathered, these processes can be routed, or information can be transmitted to the main computer.

The individual micro-computer sets include:

- Central Microprocessor Unit CPU: In the Z-80 system, the Z-80 CPU microprocessor takes over the function of the central unit.
- Memory: In the Z-80 system, various types of memory can be used.
- V/V equipment (peripheral equipment, V/V-circuit,

peripheral circuits): Four basic LSI circuits are available in the Z-80 system:

1. Z-80-PIO - parallel inputs/outputs
2. Z-80-CTC - counter/timer
3. Z-80-SIO - series inputs/outputs
4. Z-80-DMA - direct access to the memories

The individual sets are connected together by means of three collectors:

1. Address Collector -
Operates on one side, triple stand, width 16 bits; memory capacity 64 kbytes (for addressing the V/V equipment one uses the lower eight bits of the address collector);

2. Data Collector -
Triple stand on both sides, width eight bits;

3. Line Collector -
Thirteen bits

The Z-80 CPU microprocessor makes it possible to process 158 different machine instructions. These can have a length of one to four bytes.

A detailed description of the micro-computer TNS is given in Reference 1.

3.2 Description of the Program

The values of the thermo-electric voltage are sensed during the measurement and are entered into the computer program. The objective of evaluation of the cooling process is to search for critical temperatures which are typical for a given cast iron alloy. Based on the identification of the thermal effects and the desired chemical composition (in the case being described: C-, Si-, P-content in percent), the investigated alloy is classified. The program here accomplishes the following tasks (see Figure 2):

1. Recording the cooling curves and determining the critical temperatures (liquidus temperature TL, solidus temperature TS, solidification range IT, recalescence >Dt, temperature of the eutectic reaction and the elapsed time). These critical temperatures are determined through extreme value determinations on the real curves by means of the first differential quotient with respect to the time dT/dt and through determination of the turning points TA by means of the second differential quotient d^2T/dt^2;

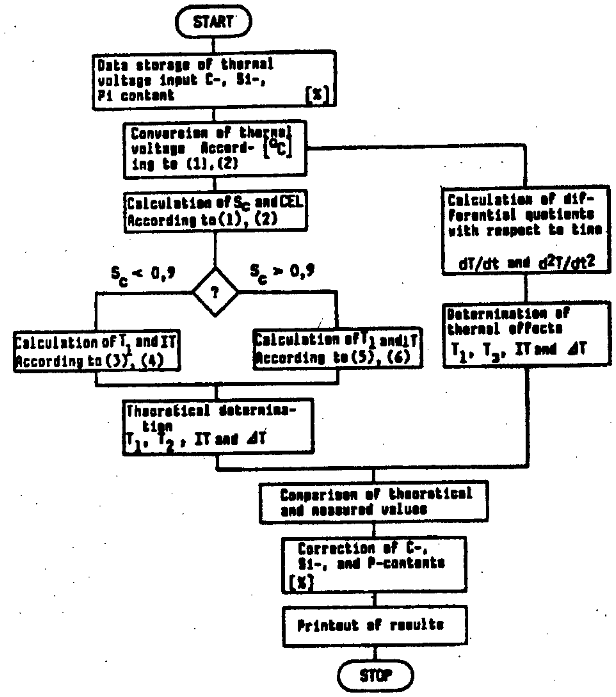


Figure 2. Program Execution Plan to Evaluate and Correct the Cast Iron Composition.

2. Step calculation of the saturation level SC and of the liquidus carbon equivalent CEL for the given chemical composition;

3. Calculation of the theoretical critical temperatures on the basis of known empirical relations [2,3,4];

4. Determination of SC and CEL on the basis of the analysis of the real cooling curve;

5. Calculation of the C-, Si-, and P-content of the specimen, and determination of the difference between the given and the determined element fraction;

6. Printout of the measurement results.

The keyboard is used by the operating personnel to enter the necessary values (C, Si and P content of the specimen

alloy being studied). The following calculations are performed:

$$SC = \%C/4.23-0.3(\%Si+\%P) \quad (1)$$
$$CEL = \%C+\%Si(4+\%P)2 \quad (2)$$

The program is designed so that, with a sub-eutectic cast iron type, the theoretical temperatures are calculated according to the Mayer equation (5):

$$TL = 1581.7-100.9 \times CEL \quad (3)$$
$$IT = 453.4-433.8 \times SC \quad (4)$$

With cast iron types which lie close to the eutectic composition, the following equations are used (2):

$$TL = 12570.7-51306\ CEL+574.9\ CEL^2 \quad (5)$$
$$IT = 3517.4-6519.8\ SC+3124.7\ SC^2 \quad (6)$$

Then follows the further execution of the program. The stored values of the thermocouple measurement are converted by means of the following equation:

$$T = 6.2617+24.9027\ U\ (ßDC) \quad (7)$$

U is the value of the thermoelectric voltage.

The TA value is calculated mathematically with the first and second derivative with respect to time at one second intervals. Thus, all temperature effects on the TA curve are identified. Then follows a comparison of measured and calculated values. By means of the back- calculation equation (4), one determines corrections for the C-, Si-, and P-content. The result of the investigations can be read on a monitor or printed out on the printer. All program sections are tested by means of control data.

4. Conclusions

The objective of the investigations described here was to develop a teaching program for student training. This possibility of quick continuous verification of the melted cast iron alloy is fully utilized under the semi-operational conditions of the institute's testing department. For precise program development, it is necessary to perform an appropriate number of practical tests so that a statistical evaluation and a precise determination of the dependencies and correction factors can be made.

The present work is linked to previously published papers investigating the problem of utilizing thermal analysis. The possibilities of linking this measurement technology to accessible computer technology, and the corresponding processing of the resulting measurement results are presented. Only with this linkage is it possible to deal with the data rapidly, to process them quickly, using also measurements which cannot be analyzed by standard evaluation methods. This method also offers considerable savings in investment. In place of special measurement apparatus, the universal possibilities of a computer are utilized, thereby taking advantage of cost-effective tool technology.

Footnotes

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Czech Multiprocessor Computing System Described

24020013 Prague MECHANIZACE A AUTOMATIZACE ADMINISTRATIVY in Slovak No 3, 1988 pp 113-114

[Article by engineer Branislav Kisa, et al.: "MXP-16 Multiprocessor"]

[Text] A few years ago computer image processing was required to solve some governmental tasks. At that time there was no device in the RVHP which would digitize a video signal up to 10 MHz and generate a 512x512 dot pattern. The research institutions VUST of A. S. Popov and VUVT Zilina initiated the research and development of computer image processing. The described system was developed in the VUVT Zilina.

The goal of the researchers was to develop a compact computer system capable of performing the following office-type tasks:

—writing and running software in a multiuser environment,
—reading, digitizing and processing of video information,

—interactive processing of video information with the computer graphics,
—data transmission in the telecommunication networks,
—data acquisition.

The software, developed concurrently, was written for the specific tasks and contains several original solutions such as:
—a method for storing a digitized image in a memory,
—multiaccess memory management, etc.

The whole system is based on RVHP components.

1. Architecture and Description of the System

The basic architecture of the MXP-16 system contains one master and sixteen slave 8-bit single-step microcomputers, locally connected to a polygonal network through the main memory segments. The microcomputer's standard features are a full capacity main memory, a multiplier, two serial RS 232 interfaces and a direct memory access. The master microcomputer is further equipped with a floppy disk controller and parallel printer port; the slave units with the D/A converters, and operational amplifiers for the generation of the analog signals. The microcomputers and the support circuitry are designed around Z80 microprocessors.

The program can call for either the selective write cycle to write into the predetermined slave microcomputer and its page, or the global write cycle to write into the predetermined page of all slave microcomputers. In both cases the program can again call for either selective or global disconnect of the slave processors. The end of the write cycle can be combined with the clear cycle. This method is used for loading the first program from the master into slave the unit.

Image processing in the MXP-16 is based on the multiprocessor architecture. Parallel processing makes conditions and analysis of the video information together with the interactive graphics possible in an acceptable length of time, without the use of any special video processors.

The input to the MXP-16 is a television video signal controlled by the synchronizer in the scanning mode in the range of 1 V DC and in the switchable bands of -0.5 V to +0.5 V, 0 V to 1 V and 0.8 V to 1.8 V.

From the television picture, the first 512 lines are digitized by the A/D converter into 128 levels of gray and then gradually, in bytes, written into one of four software-selectable pages in the computer memory.

The computer video memory is divided into sixteen autonomous segments in such a way that one segment contains 16 KB from each video page. This type of peripheral distribution makes it easy to match the different speeds of the DRAMs used to the rate of digitization and monitoring, by using the method of gradual, time-shifted access to individual segments. In the final memory arrangement the address generator, which is a part of each segment, outputs a train of sixteen shift pulses to clock sixteen bits of data into memory.

The segment of video memory is identical to the main memory of the slave microcomputer. The mapping of the neighboring left and right segments in 16 KB pages is the same for both the master and slave microcomputers. This method together with the direct memory access circuitry accomplishes a fast transfer of the video information in the horizontal and vertical direction of the video page, or a transfer of the video information among the pages.

Any video page can be digitized by the three fast D/A converters to obtain the RGB outputs for the color monitor. At these outputs, each byte of the video page is interpreted as either a 1x128 voltage level (in the band 0.8 V to 1.8 V, or 0 V to 1 V) for the black and white picture, or as 3x4 levels for the color picture. The selection of the conversion method is data-controlled and, therefore, it is possible to generate 128 levels of gray and 64 colors in one image. Any video page with 512 lines or interlaced 256 lines can be monitored.

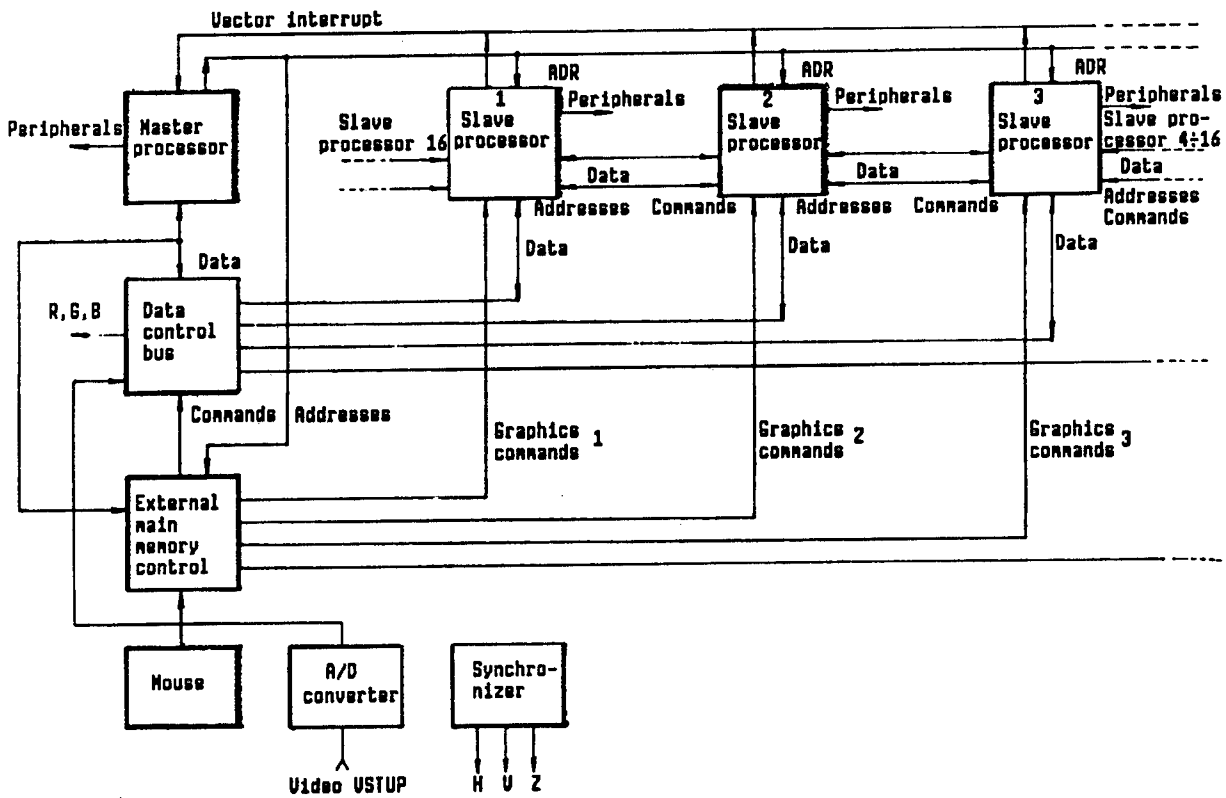
Part of the interactive image processing is the mouse, which by hand rotation, generates two signals dependent upon the angle of rotation which is projected onto the two perpendicular axes of the mouse.

2. Software

The MXP-16 software is based on the modular MXP-DOS system compatible with the CP/M which is written in four versions:
—multiuser version with RAM disk for fast processing of many disk operations;
—multiuser version for connection of up to sixteen terminals with mutual file protection;
—multiprocessor version for full parallel computational performance from one workstation by distribution of independent programs to individual slave microcomputers and their controllers;
—graphics version for the processing of the video information and interactive graphics by distribution of the (external) functions to the slave processors. All the programming tools are available to the user to create the specific function for the required solution.

For the above versions, any CP/M programming tool, such as language translators, editors, databases, data buses, etc. is available.

The efficiency of the MXP-16 parallel processing can be documented by the length of some graphic functions processing. For example, the histogram computation takes 0.8 s, the image conversion according to the conversion table requires 0.4 s and the transfer of the picture between the pages takes only 0.05 s.



MXP-16 Block Diagram

3. Technical Parameters

Basic computational unit:
—17 microcomputers based on UB 880 D with 1 MB+64 KB main memory divided in 16 KB pages;
—operational speed: 160000 to 4 million operations per second;
—128 level interrupt system.

Input and output:
—CM 7202 or CM 7202 MI monitor;
—25 Hz, 625-line externally synchronized TV 11-36/TV 22-22 TV camera;
—data communication links: CCITT-V24;
—8" x 2x610 KB floppy disks or IBM standard;
—mouse;
—RGB television color monitor, 512x512 dots or interlaced 512x256 pixels with 64 colors and 128 levels of gray per picture;
—CONSUL 2111 printer with parallel interface;
—D 100 printer with serial interface;
—20 MB Winchester disk (in development).

Operating requirements
—ambient temperature: +15 degrees C to +35 degrees C;
—relative humidity: 40 percent to 80 percent at 30 degrees C.

Supply voltage: 220 V/50 Hz, 0.75 kW.

Dimensions (desktop configuration):
—height, 720 mm,
—depth, 760 mm,
—width, 1,500 mm.

Weight: ca 100 kg.

Editorial remark: The color photo of the MXP-16 computer is on the cover of this issue. The picture was taken last fall at the exhibition in Brno.

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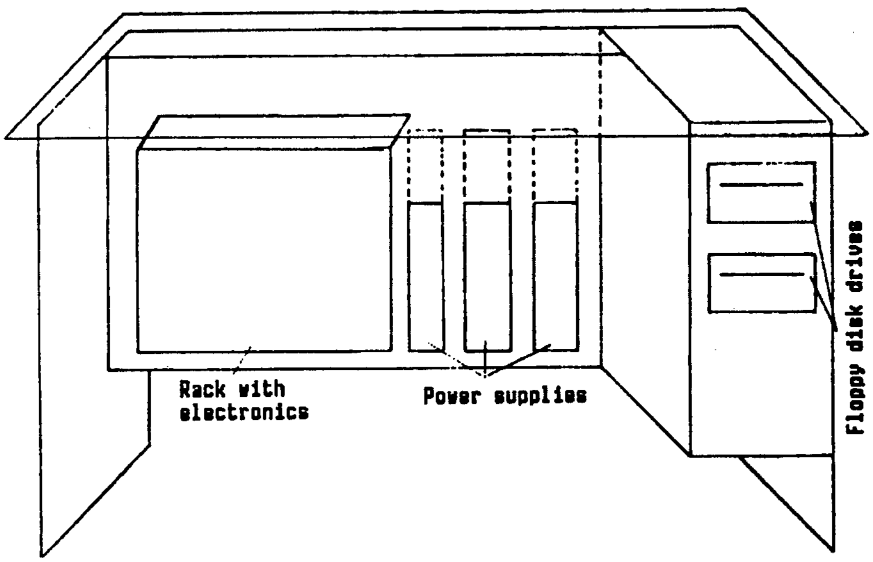

MXP-16 Structural Design

GRD Developing Improved Computer Multiprocessing Capability

23020021 East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German No 5, 1988 pp 16-20

[Article by Christian Mirtschink and Wolfgang Hertwig: "Gateway To Coupling of ESER and 32-Bit Multiprocessing Systems"]

[Text] Data processing system producers currently offer hard- and software components, which allow the establishment of multiprocessing networks (RVS). These RVS's are determined by their logical, functional, and physical properties and offer the user a defined range of functions.

The differentiation of existing multiprocessing systems with respect to their functionality and architecture results primarily from the various objective functions and the technical possibilities of the manufacturers' hardware, as well as from the absence of standards which specify the communications and service protocols at the time of their implementation.

The construction of RVS, in which computer systems of various architectures are able to communicate with one another, is the object of numerous publications and practical implementations. In this context the OSI [open systems interconnection] reference model forms the framework for many projects and is the basis for the definition of standards, in order to define generally recognized agreements regarding the physical and logical interface conditions in the form of standardized communications protocols and services. At the present, the first RVS's based on this standardized protocol are in existence internationally.

At the Microelectronics Research Center VEB in Dresden (ZMD), operated by the Carl Zeiss Jena Combine VEB, computers of the ESER system (EC 1056) as well as 32-bit computers are used in order to process problems in integrated circuit design (CAD) and to control the integrated circuit production (CAM). This computer technology is coupled to the respective manufacturer's local RVS (ESER-RVS, SKR-RVS) (Figure 1).

In order to achieve a loading and communications linkage between the two systems, a coupling based on the gateway principle (Figure 2) was effected. In addition to creating a concrete operation-specific solution to the data transfer between multiprocessing systems, it had to be demonstrated that principles of the ISO [International Standards Organization] reference model and elements of the standard to be based on it are also usable when connecting non-standard RVS, that is to say in the sense of transferring the conceptional principles of the ISO reference model.

In order to fulfill the global demand for an overall computer-technical system for efficient processing of data for integrated circuit design and manufacture, the following services are offered the user:

- File Transfer (FT)
- Remote Job Entry (RJE)
- Remote Terminal Access (RTA)
- Operator communication
- Program communication.

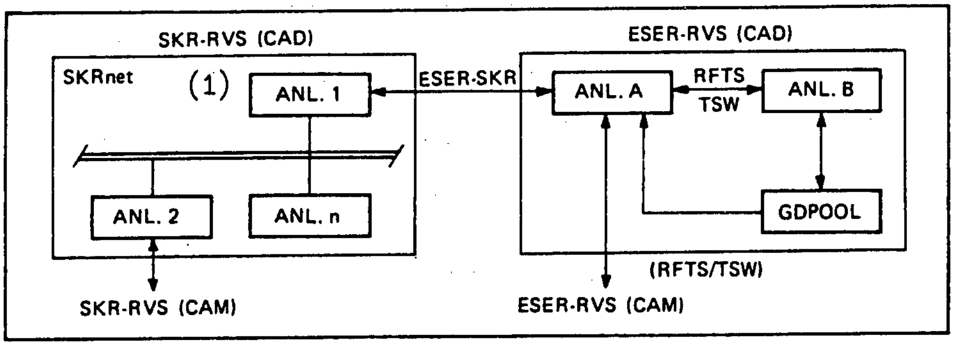

Figure 1. ESER-SKR-Coupling in ZMD's Multicomputer Network

Key:
1. Facility 1 [A, B, etc.]

The required user services can be divided into two classes:

—1. Services, for which the initiator immediately waits for the result of the initiated action. Characteristic of these services is the transfer of smaller data volumes (user communication, program communication and Remote Terminal Access).

—2. Services, for which the initiator does not immediately wait for the result of the initiated action. This involves the transfer of large data bases which are needed for executing orders (Remote Job Entry and File Transfer).

Characteristics of the Local RVS

Local ESER-Computer Networks

The primary objective function of the local ESER-RVS consists of realizing a loading linkage to provide an effective form of processing resource-intensive batch jobs and a high-capacity conversational mode.

The forms of data transfer in the ESER RVS's are:

- Access to jointly used microprocessor data bases—using the "local interactive job system—LIAS" for the transfer of job, input and output files between batch and dialog systems
- RFTS: Transfer of datasets between dialog users of actual facilities
- TSW: Offering a dialog access for users of any dialog computers of the TSW network.

Local 32-Bit Multiprocessor Systems

The software package to set up a homogeneous SKR-RVS is based on a logical multilayer model and offers the following services in the applications layer:

- File transfer
- Start of command datasets in remote network nodes

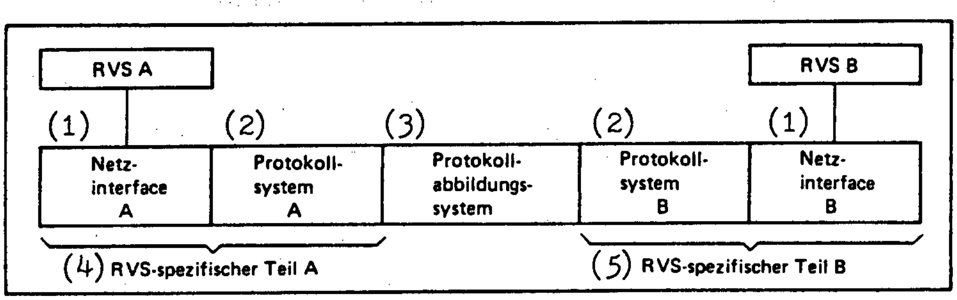

Figure 2. General Gateway Model

Key:
1. Network interface A
2. Protocol system A
3. Protocol mapping system
4. RVS-specific part A
5. RVS-specific part B

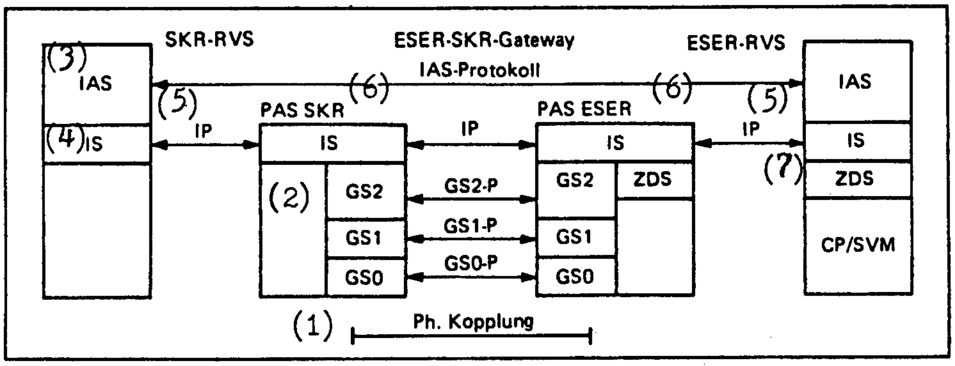

Figure 3. Logical Protocol Structure of the ESER-SKR Gateway

Key:
1. Ph coupling
2. Gateway layers 2, 1, 0, etc.
3. Internet application layer
4. Internet layer
5. Interne protocol
6. Protocol mapping system
7. Additional service layers

- Remote File Access
- User-guided communication between application programs on computers of the local RVS
- Dialog access to any nodes of the computer network.

Connectivity Strategy

Evaluation of the possible connectivity strategies and consideration of the given hard- and software restrictions led to the following connectivity strategy:

- Conversion of the architecture-specific communications protocols takes place by means of two protocol mapping systems (PAS)
- Implementation of the PAS takes place in a computer belonging to the RVS to be connected
- Coupling to the ESER-RVS takes place under SVM/ES via the PTS [buffer timing control] dialog system
- The coupling hardware is allocated to the mapping systems as exclusive operating means
- It is the task of the PAS to map the local communcations protocols on neutral protocol architecture, which is defined for communication between the PAS. This protocol architecture consists of several layers
- For the communication between end users in the end systems (ES) an internet protocol (IP) is defined, which is realized by an internet layer (IS)
- Above the internet layer, in both RVS's additional application services are implemented for the required funcionality and combined in an internet application layer (IAS)
- The transformation of syntactically different forms of representation takes place within the application services in the end system. The required procedures are readied in the end system. The data are transferred in the graphic rendition of the receiver
- In order to assure equal participation of all ESER end systems in the internet communication, it is necessary to implement more service layers (ZDS) in addition to the RFTS and TSW services available in the ESER-RVS.

Hardware Components

On the hardware side, the coupling of the RVS's takes place through a (relative to the code transparency) modified GSE EC 7922 and a KIF controller (Figure 4). The KIF controller consists of the principal complexes UNIBUS controller, RAM complex (buffer storage) and KIF controller. The KIF controller is a special device for the UNIBUS and is controlled by four 16-bit registers. Normal coaxial cable is used as a link between GSE EC 7922 and the KIF controller. Of the hardware facilities, the following services are furnished:

- Hardware-side coupling of the RVS and adaptation of the given input/output interfaces (KIF interface/UNIBUS interface)
- Assurance of a high transmission speed
- Coupling of the RVS through an intermediate range of distance (maximum 1,200 meters)
- Assurance of collision-free data transmission.

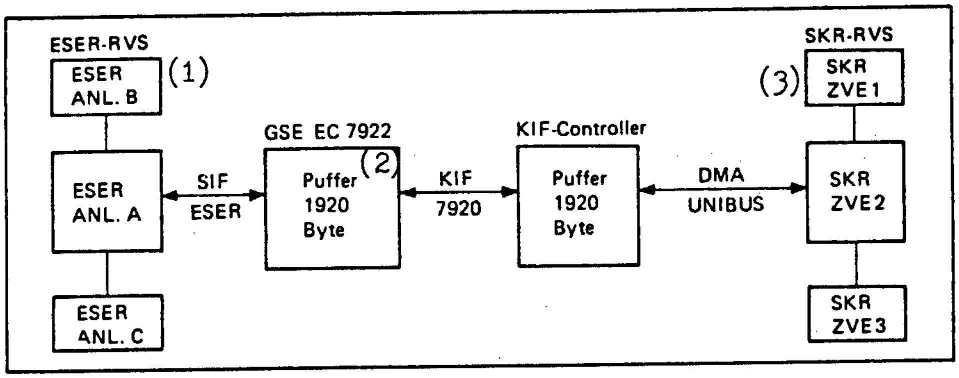

Figure 4. Functional Hardware Components

Key:
1. ESER facility A, B, C
2. Buffer; 1920 bytes
3. SKR ZVE

Software Components

In contrast to other gateway concepts, the connection of the RVS's takes place on the level of the application layer by means of two protocol mapping systems [PAS]. It is the task of these PAS's to control and monitor the entire data transfer between the end users of the coupled RVS's and the realization of the transformation service between gateway protocol and the protocol system of the respective RVS. The layers and protocols depicted in Figure 3 are realized by the following functional software components:

PAS-ESER/PAS-SKR
This software component consists of several layers.

—1. Interface to the local RVS.

It is the task of the interface to the respective protocol systems to simulate the anticipated communication partner for the local protocol system, meaning prepare the communication protocols used in the local area. The fact that in the ESER-RVS no uniform interface to the data transfer exists between the end users (IUCV, SPOOL-system, RFTS, TSW, LIAS) is a disadvantage.

—2. Gateway-Protocol-Module

It is the task of this component, consisting of several layers, to realize the neutral gateway protocol. This protocol is based on the principles of protocols of the session and transport layer of the OSI reference model:

—Gateway Layer 0 (GS0)

Software side integration of the coupling hardware with the respective operating system and readying of services for sending and receiving of data blocks (maximum 1,920 bytes).

—Gateway Layer 1 (GS1)

Based on the setup and synchronization offered by GS0, the levels of this layer result in a real data connection (transparent transmission of PDU in the internet layer, readying of flow regulator mechanisms).

—Internet Layer (IS) in PAS

The functionality of IS within the PAS is limited to recognition of error situations and the resulting necessity to generate IS-PDU.

Internet Layer in End Systems

On the basis of the communications services available in the local RVS, services to establish and synchronize end-to-end connections between end users of the RVS are readied.

Synchronization of the connection setup takes place by means of a two- way handshake mechanism. After that, the initiator (master) of the established connection has the right to send data. By sending a "GIVE TOKEN" data unit, the right to send can be transferred from the master to the partner (slave), who now becomes master. Regular disconnection also takes place through a two-way handshake mechanism, in which the right to initiate the disconnection lies with the master. By sending an "ABORT" data unit, both the end users and the PAS can disconnect the link.

Internet Application Layer (IAS)

Application services and application-related protocols are realized through the services of the IS.

Gateway Control Program (GCP)

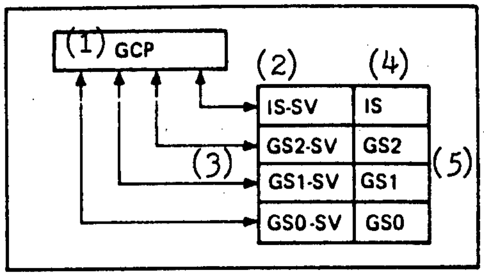

Figure 5. Logical Arrangement of Functions for Layer Management

Key:
1. Gateway control program
2. Internet layer-layer management
3. Gateway layer 2 [1, 0]-layer management
4. Internet layer
5. Gateway layer 2 [1, 0]

The GCP serves the systems operator or systems programmer to realize administrative functions. These functions are indispensable for an orderly operation of the gateway and are an essential aid for recognizing error situations and the effectivization of the gateway software (starting and ending the gateway software, indicating gateway status information, dynamic change in parameters, recording the gateway operation—monitor function).

In order to realize these functions, the GCP communicates with levels for layer management (SV), which are implemented within the layers (Figure 5).

ESER-User Services

—*Operator Communication*: The sending of information to users of interactive processes of the SKR- RVS and indication of load parameters.

—*File Transfer*: Transfer of files to the SKR-RVS.

—*Remote Job Entry: This service allows PTS [buffer timing control] users to start command files in the SKR-RVS end systems. By specifying options it is possible to achieve immediate display of the results on the ESER terminal.*

—*Remote Print*: Output of ESER printing data on SKR-RVS printers.

—*Remote Terminal Access*: PTS users can create a process in each end system of the SKR-RVS and can interactively service commands.

In the currently implemented version, the ESER application services can only be used by users of Facility A (Figure 1). Users of other ESER facilities must first create a link to Facility A via TSW.

SKR Application Services

—*Operator Communication*: The sending of data to User-VM [virtual memory] of the ESER and indication load parameters.

—*File Transfer*: Transfer of files to the ESER-RVS.

- Transfer of files to the reader of a VM
- Transfer of files to the MINI-DISK of a VM
- Transfer of files to a file disc in the SVS/ES [receive circuit]

—*Remote Print*: Printing of files by the ESER

—*Remote Job Entry*: This service allows SKR users to transfer jobs to LIAS for processing in the ESER batch system SVS/ES.

ESER/GO: Sending a job
ESER/LOOK: Indication of status information for the job
ESER/PCHANGE: Modification of the status of a job
ESER/PRIOR: Modification of the priority
ESER/RESULT: Feedback of result data

In order to increase the user friendliness of the remote job entry service, an interface for automatic generation of ESER batch jobs is made available in SKR.

Effects

With the version of ESER-SKR gateways implemented at the Dresden Microelectronics Research Center, for the first time an online connection between the RVS's involved was achieved. The gateway offers the preconditions for effective and flexible use of 32-bit SKR and ESER computer technology. The online connection contributes considerably to the increase in user friendliness and handling ability of the overall system. Depending on the user function, at the moment an average effective transmission rate of 6 kB/s is achieved. With a direct line from the gateway software in the SVM (analog to the TSW), a considerable gain in efficiency would be possible.

Through implementation, considerable knowledge was gained for the layout of the gateway. It was demonstrated that the principles of the OSI model and the standards based on it are also usable under the conditions of already existing nonstandard RVS's.

A subsequent use of the gateway software is possible under the following marginal conditions:

- Application of the SMnet network software to the 32-bit computing technology.
- The presence of the GSE EC 7922 coupling hardware and KIF controller (with functional and constructive documents available)
- Utilization of the PTS dialog system with SVM/ESP

Bibliography for the article may be requested from the editorial staff.

11949

LASERS, SENSORS, OPTICS

GDR Installs New One-Meter Reflecting Telescope in USSR

23020020b East Berlin NEUES DEUTSCHLAND in German, 30 Jun 88 [page not indicated]

[Text]A new one-meter reflecting telescope, manufactured at the GDR's VEB Carl Zeiss Jena Combine, is being installed at the USSR Academy of Sciences' Simeis satellite tracking station in the Crimea. The device which will be erected on "Cat Mountain," 340 meters above the Black Sea, is to be used for stellar observation and for taking spectrographic photographs. Its use in the completion of tasks within the framework of the international PHOBOS mission is also being envisioned. For several years now, telescopes of this sort, manufactured by the GDR combine, have been successfully employed in the Tajik SSR and around the Alma Ata region.

MICROELECTRONICS

Director Describes Work of Hungarian Computer Technology Institute

25020039b Budapest MAGYAR ELEKTRONIKA in Hungarian No 1, 1988, p 3

[Interview with Janos Szlanko, director of the MSZKI (Measurement and Computer Technology Research Institute) of the KFKI (Central Physics Research Institute), by Bela Laczko]

[Text] MAGYAR ELEKTRONIKA: The MSZKI occupies a distinguished place in domestic computer technology development. How did a computer technology research base develop in this "physics environment" and what is the essence of your developmental concept?

Janos Szlanko: The KFKI is one of the largest and most modern research centers of Central Europe. It embraces five main research areas and thus five independent research institutes. This means the coexistence of several areas, which creates a good opportunity for the solution of interdisciplinary tasks.

The profile of the MSZKI developed in this environment. The "physics environment" which you mentioned was what called this institute into being. Solid body physics, particle and nuclear physics and nuclear power research require very high level measurement techniques and the processing of large volumes of data. The link between the measuring instruments and the computer processing the data can be created only with computer technology devices. Development of intelligent measurement data collectors was the first area in which the MSZKI achieved results, and it is still a very important area. I cite here the CAMAC system, recognized by many, or the multichannel analyzer used in nuclear measurement technology, but our measurement and control technology devices work in many other areas.

The system prepared for the Paks Nuclear Power Plant Enterprise was an outstanding example of interdisciplinary cooperation. The expertise from both the nuclear power and the computer technology side existed within the KFKI, and the cooperation was easy too.

So-called DEC compatible systems are developed by the MSZKI. A number of factors are involved in this. I mention first that when they developed the first computers—this was the family of TPA-8 small computers—it was not yet possible to know that the Digital Equipment Company was creating the basis for a world standard. We were really lucky in this regard, and today we deliberately follow the DEC developments. I note only in parentheses that—in my opinion—it is senseless to have an independent computer development concept in Hungary. The several hundred or thousand man-years of research experience which a leading world firm has accumulated is indispensable. Just to learn what they already know, to follow it and apply it properly and use it in systems is a real task, and this does not exceed our strength.

The 40 and 400 series of the TPA-11 family followed the TPA-8; this was the age of 16 bit architecture machines. The TPA 11/500 machines are already 32 bit machines, VAX compatible in software, and represent the so-called megamini category. I would like to say more about these in connection with the third question, for they are the hardware base for CAD/CAM systems.

The other factor which I would like to emphasize is that the MSZKI is an applications oriented institute. Computer manufacture is not a goal, it is a tool. The task is the central thing; the hardware is a tool necessary for its solution. We sell systems and develop systems, and as background for this we develop and manufacture our computers and connecting units.

MAGYAR ELEKTRONIKA: How does a research institute deal with small series manufacture? Does its organizational position represent an advantage or a disadvantage?

Janos Szlanko: The KFKI had a joint manufacturing base with Videoton and the SZKI [Computer Technology Research Institute and Innovation Center], the SZKUBT [Computer Technology Experimental Plant Deposit Association]. This association disbanded and its legal successor undertook to help us with assembly to a decreasing degree. Even earlier the testing and installation of systems for special applications were done at the institute, so we were already set up for this. Now we want to create a modern manufacturing base on new technological foundations, and we already have some of the technological equipment for this. We feel that this is absolutely necessary to make highly reliable, high performance systems.

We can work well in the present organizational setup; from many viewpoints the KFKI represents an advantage. I am thinking here primarily of the infrastructure, the presence of many types of experts. In other respects, e.g. in parts acquisition, etc., we start from the same position as other domestic manufacturers.

MAGYAR ELEKTRONIKA: What developmental trends is the MSZKI following in the area of CAD/CAM?

Janos Szlanko: Let me start by repeating that we are applications oriented. This now means that our CAD/CAM development is part of an innovation process involving computer development and the development of systems based thereon. But since we have a computer we developed ourselves our CAD system is built on this hardware base. (For the time being we have no real CAM system.) So our CAD development tries to satisfy the needs of our own computer development, but at the same time the experience gained—including the 11/500 series computer—can be sold as an applications system too.

Our developmental philosophy—following from the above—is primarily an applications one, not a basic development one. We buy what we can and do not start, for example, the development of printed circuit designing programs from the ground up; others have undertaken this. So we can deliver a VAX compatible machine for mechanical applications. The development of a CAM system is a theme for the SZTAKI [Computer Technology and Automation Research Institute].

8984

Hungary: Use of TPA 11/500 Computer for Electronic Design Systems

25020039c Budapest MAGYAR ELEKTRONIKA in Hungarian No 1, 1988, pp 7-12

[Article by Antal Ritter, Andras Szep and Gyorgy Szondy: "Electronics Designing Systems on the TPA-11/500 Computers"]

[Excerpts] The article briefly summarizes electronics applications of computer aided design. It deals in more detail with wiring programs and use of KFKI [Central Physics Research Institute] computers in the 11/500 series.

Introduction

Fortunately significant changes have taken place in our country in the recent past also. The first computers which meet the demands made of a device base for CAD systems have appeared. Thanks to this the development and use of CAD/CAM systems have been going on in a few institutions for several years. In our article we would like to publish experiences gained by the Central Physics Research Institute of the MTA [Hungarian Academy of Sciences] in the use of electronics designing systems. At our institute, two years ago, a CAD center was built based on a two-processor TPA-11/580 computer. There are now ten graphics workstations at the disposal of designers. These include IBM PC based graphics terminals with emulator programs and high speed, high resolution graphics workstations. This setup is being constantly expanded and as a member of the institute's local network it is accessible to a large number of design engineers.

Experiences

Large printed circuit designing systems have been used by the Measurement and Computer Technology Research Institute of the KFKI for about a year. We have designed a number of cards from small circuits containing 40-45 IC's to 40 x 40 centimeter cards containing 180 capsules. For such circuits containing 180 capsules the input of connections with the schema editor takes three weeks. This includes the time to load the libraries and the time to correct possible errors. One must define the outlines of the cards, those areas through which a conducting band cannot run, the necessary orienting holes and the technological framework.

The time and difficulty of wiring do not increase linearly with the size of the card or the number of connections but rather at a good bit faster pace. Wiring small, rare cards takes a few hours. Completing large, tangled cards containing many running signals can last 2-3 weeks. As we already mentioned the line thickness with which the system works is not at all a matter of indifference. On a dense card where 200 unconnected leads with a line thickness of 0.3 mm remain after automatic wiring it will be an order of magnitude of ten with a 0.25 mm line thickness.

The unstoppable development of computer technology and user demand for ever faster and larger capacity computers inescapably raises the requirement that newer generation machines not be built on a discrete parts base but rather be designed at the component level. The use of CAD systems for the design of printed circuits substantially facilitates the conversion to this design technology. Of special significance in the design of IC's is the use of simulators; without them it is practically impossible to make circuits meeting the specifications. We hope that access to the use of modern IC manufacturing technology will not find the KFKI designing engineers unprepared so that they will immediately be able to exploit the possibilities given by technology by using CAD systems.

Autobiographic Notes

Antal Ritter: I graduated from the Electrical Engineering School of the Budapest Technical University in 1987, in the data and telecommunications technology branch. I joined in the work of the CAD group then formed by working 18 hours per week even while in the university. It was here that I planned by diploma thesis with the title "The Role of Electronic CAD Systems in the Design of Highly Reliable Circuits."

Andras Szep: I graduated from the Moscow Power Engineering Institute in 1979 as a systems engineer in the automation and computer technology branch. I began to work at the KFKI after finishing the university. Between 1982 and 1985 I was a graduate student, again at the Moscow university. I earned a candidate's degree here in November 1985. Since January 1986 I have been a member of the CAD group in the Central Physics Research Institute of the MTA.

Gyorgy Szondy: I graduated from the Electrical Engineering School of the Budapest Technical University in 1985. In 1986 I placed first with my diploma thesis in the diploma plan competition of the Communications Engineering Scientific Association. I dealt with digital image processing and transmission in the microwave faculty of the technical university. I now work in the area of electronic CAD applications at the Central Physics Research Institute of the MTA.

8984

Table of Contents of Hungarian Electronics Journal

25020039a Budapest MAGYAR ELEKTRONIKA in Hungarian No 1, 1988 p 2

[Text]

Table of Contents

On Our Cover

On our cover is the CAD system of the Measurement and Computer Technology Research Institute of the KFKI. The CAD system developed for TPA 11/500 series computers is similar to the VAX compatible systems popular throughout the world. The powerful hardware and many-sided software offer effective support for designers. Workers from the MSZKI describe electronics applications of the CAD system in their articles.

CAD

Under the CAD title we bring together works which describe electronics applications of domestically developed CAD-CAM systems. In addition to workers from the KFKI people from the SZTAKI [Computer Technology and Automation Research Institute], the IKI and the EMG describe their latest developmental achievements. Modern electronic equipment design is less and less able to do without computerized support. The complexity of the equipment and the increasing complexity of parts place ever more difficult tasks before designers. Preparing documentation represents a special difficulty; this is extraordinarily labor intensive and the possibility of error is great.

Modern electronic CAD systems are linked directly to manufacture; the photoplotter control program produces the drilling machine tape immediately after layout design.

Panorama

In our Panorama section we summarize developments in the field of power electronics devices. This field, difficult to conquer with semiconductors, is developing more and

more, the power of discrete semiconductor devices is increasing and the power stage is increasingly integrated with logic functions. We hope that the summary published here will be of interest to Hungarian experts as well.

8984

SCIENCE & TECHNOLOGY POLICY

GDR Research Collaboration Expanded

23020020a East Berlin NEUES DEUTSCHLAND in German 14-15 May 88

[Text] On Friday, 13 May 1988, in Berlin, the president of the GDR Academy of Sciences, Prof Dr Werner Scheler and the GDR's Ministry of Construction of Machine Tools and Processing Machinery, Dr Rudi Georgi, conferred about the further intensification of scientific and research collaboration. The focal points for the collaborative effort are the broad application of microelectronics in the formulation of CAD/CAM approaches, the development and introduction of modern control engineering, and the application of laser technology in the construction of machine tools. The partners focused a significant amount of attention upon materials research, including the development of hard metals, modern coating techniques and new abrasives. Other areas for collaboration are modern measurement techniques along with the attendant sensor and measurement equipment as well as new mechanical engineering approaches for drive technology, precision machining and noise suppression.

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